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IMPLEMENTATION OF THE NATIONAL PLAN OF ACTION FOR CONSERVATION AND MANAGEMENT OF SHARK RESOURCES IN MALAYSIA (MALAYSIA NPOA-SHARK)

(TERMINAL REPORT)

By

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Acknowledgements

This book is the outcome of a one-year comprehensive study of data collection on sharks and rays landings in the State of Perak, Malaysia in 2013. The study was funded by the Food and Agriculture Organization of the United Nations (FAO) through Bay of Bengal Large Marine Ecosystem (BOBLME).

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EXECUTIVE SUMMARY

This project was the outcome of The Regional Workshop on the Development of the Regional Management Plan (RPOA) for Sharks in the BOBLME Region held in Male, Maldives from 5-7 July 2011. The project was undertaken to address the need to record landing data up to species level and to create awareness on sharks and rays conservation among stakeholders in Malaysia. The Food and Agriculture Organization of the United Nations (FAO) through BOBLME had agreed to fund a one-year pilot project for conducting activity in the State of Perak starting January 2013. A letter of agreement to that effect was signed between Malaysia and FAO granting support of US$25,000 through the Marine Fishery Resources Development and Management Department, Southeast Asian Fisheries Development Centre (SEAFDEC/MFRDMD). The project aimed to enhance human resource development in elasmobranch taxonomy, increase awareness on conservation and to improve landing data recording from generic 'sharks' and 'rays' to species level.

Three awareness events on conservation of sharks and rays were held at Kuala Sepetang on 28 May, Lumut on 29 May and Bagan Datoh on 30 May 2013; all in the state of Perak. Each one-day event was jointly organized by SEAFDEC/MFRDMD, Perak State Fisheries Office and the Extension Division of the Department of Fisheries Malaysia. Activities during the event included exhibition of posters and materials of endangered species, including sharks and rays, lectures on conservation and management of sharks and rays and discussions with stakeholders on the need to conserve sharks and rays species especially whale shark and saw fishes (family Pristidae). All together between 500-1000 visitors including fishers and their family, pupils and local government officials visited at each campaign site. News of the events were also published in local newspapers. Another three stakeholder consultation sessions for implementing the National Plan of Action for the Conservation and Management of Shark (NPOA-Shark) were held at Federal Territory of Putrajaya, Semporna in Sabah and Kuching in Sarawak. About 70-200 participants from relevant government agencies, fisheries association, private sectors, non-governmental organisations, fishers, researchers and local lecturers attended at each consultation. These consultations aimed to compile feedbacks from stakeholders on their views and opinions on the current implementation of the NPOA-Shark and future plans on conservation and management of sharks. A special report on these activities was submitted earlier.

A pilot project on recording landing data of sharks and rays up to species level was conducted in the State of Perak. During this project 16 officers of DoFM were trained in taxonomy and in data collection using the new harmonized format. Three districts facing the Straits of Malacca, namely Larut Matang, Manjung Selatan and Hilir Perak were selected as the study sites as they were the main landing sites of sharks and rays in the state. The landing data were collected at 11 jetties i.e five in Larut Matang, four in Manjung and two in Hilir Perak.

A total of 13 species of sharks from two Orders and four Families, and 17 spesies of rays from three Orders and six Families were recorded. Manjung Selatan recorded the highest with eight species of sharks and 13 rays, Larut Matang with eight species of sharks and 12 rays, and Hilir Perak with 10 species of sharks and nine rays. In term of percentage of total marin landings, sharks and rays only contributed 0.7% and 1.7% at Hilir Perak, 1.1% and 3.7% at Manjung Selatan, and 1.2% and 0.5% at Larut matang respectivley. These figures confirmed earlier data as published in Malaysian National Statistics that sharks and rays were only by-catch and not targeted and contributed to about 2% of the total marine landing.

The most abundant shark species at Hilir Perak were *Chiloscyllium punctatum, Chiloscyllium hasseltii* and *Scoliodon laticaudus* and for rays *Himantura gerrardi, Dasyatis zugei* and *Himantura walga*. The most common shark species were *Chiloscyllium punctatum* and *Chiloscyllium hasseltii* while for rays *Himantura gerrardi, Dasyatis zugei* and *Neotrygon kuhlii*.

The most abundant sharks species at Manjung Selatan were *Chiloscyllium hasseltii, Chiloscyllium punctatum* and *Atelomycterus marmoratus* while for rays *Neotrygon kuhlii, Himantura gerrardi* and *Dasyatis zugei*. The most common shark species were *Chiloscyllium hasseltii* and *Chiloscyllium punctatum* while for rays *Neotrygon kuhlii, Himantura gerrardi, Dasyatis zugei, Gymnura japonica, Dasyatis fluviorum* and *Himatura walga*.

The most abundant sharks species at Larut Matang were *Chiloscyllium hasseltii, Chiloscyllium punctatum* and *Carcharhinus sorrah* while for rays *Neotrygon kuhlii, Himantura gerrardi* and *Dasyatis zugei*. The most common sharks were *Chiloscyllium hasseltii, Chiloscyllium punctatum* and *Atelomycterus marmoratus* while for rays *Neotrygon kuhlii, Himantura gerrardi, Dasyatis zugei* and *Rhynchobatus australiae*.

All big sized sharks of more than two meters in total length such as *Carcharhinus leucas, Carcharhinus sorrah, Galeocerdo cuvier, Sphyrna lewini, Carcharhinus melanopterus* and medium sized sharks such as *Carcharhinus sealei* and *Rhizoprionodon acutus* were rarely caught due to nature of fishing area and gear used. Usage and marketing information from this study also confirmed earlier report in the current NPOA-Shark that all sharks and rays were landed whole, fully utilised with no finning activities on board of vessels.

Background

The Regional Workshop on the Development of the Regional Management Plan (RPOA) for Sharks in the BOBLME Region held in Male, Maldives from 5-7 July 2011, also recommended that countries should identify several landing sites as pilot project to collect and report catch data by species. In order to address the need to record landing data up to the species level and create awareness on sharks and rays conservation among the stake holders, the Food and Agriculture Organization of the United Nations (FAO) through BOBLME had agreed to fund a one-year pilot project in Malaysia. A letter of agreement to that effect was signed between Malaysia and FAO granting support of US$25,000 through the Marine Fishery Resources Development and Management Department, Southeast Asian Fisheries Development Centre (SEAFDEC/MFRDMD) for conducting a one-year activity starting January 2013.

Objective

The objectives of this project were:

- to improve data collection on shark landings with regard to species identification:
- to increase awareness of needs and measures for shark conservation and management among stakeholders:

Implementation of Project

Data Collection

SEAFDEC/MFRDMD organized a training course on shark and ray taxonomy for 16 officers (biologists) with good knowledge of taxonomy and biology of the most common species of sharks and rays. The course contents determined by SEAFDEC's shark specialists and species identification guides from SEAFDEC were used in the training. Specimens of sharks and rays used in the training were later added to the SEAFDEC/MFRDMD Depository. The details of the training course are shown in **Annex 1 (Appendix I)**.

A one-year pilot programme was then implemented for recording shark data down to species level from three districts in Perak State (Hutan Melintang, Manjung Selatan and Larut Matang) but at present only recorded under the generic terms "sharks" and "rays". The pilot programme helped in identifying problems and issues to be considered for nation-wide introduction of such a data collection format and harmonized with existing data collection system. Details of the harmonized format for the data collection form are shown in **Annex 1 (Appendix II)**

Awareness Building

In order to assess the critical issues in the NPOA-Shark from the viewpoint of different stakeholders, a series of three consultations at Putrajaya; Kuching, Sarawak; and Semporna,

Sabah were organized to discuss any improvements to be made to the existing NPOA. A wide range of stakeholders, i.e. fishers, fish traders, fisheries associations, fishery port managers, fisheries researchers, officials, and university lecturers participated in the consultations. The details of the consultations are reported as in **Annex 2.**

Another activity carried out was that on outreach to fishers' community, school children, and local government officials. The campaign consisted of dialogues, lectures and exhibition of posters of endangered species including sharks and rays. Printed materials such as posters on the need to conserve sharks and rays were distributed during the campaign. The details of the consultations are reported as in **Annex 3.**

Outcome

a. The project was successful in its objective to improve the Department of Fisheries Malaysia (DoFM) data collection on shark landings especially with regards to species identification. During this pilot project 16 officers of DoFM were trained in taxonomy and in data collection using the new harmonized format. The training modules and data collection format will be used by DoFM in other sites. SEAFDEC has, during its 'Regional Technical Working Group Meeting on Data Collection for Sharks in Southeast Asian Region' conducted in Phuket on 22-24 April 2014 also adopted the same data collection format for use in other member countries The details of the pilot project on data collection and training are reported as in **Annex 1.**

b. The second objective to increase awareness of needs and measures for shark conservation and management among stakeholders was also successfully implemented. The series of consultations on the NPOA-Shark provided many useful suggestions which had since been incorporated into the improved version of the NPOA. The awareness campaigns carried out among fishers and other members of the community including school children and local officials were successful in that there was generally a better understanding of the issues such as the need for conservation and management of certain species of sharks and rays. The details of the consultations are reported as in **Annexes 2** and **3.**

Financial Report

Until 31 March 2014, a total of US$20,000 was received of the total sum of US$25,000 allocated. All activities were completed as scheduled with budget was spent according to the proposal and details are shown in **Annex 4.**

Conclusion

The data collection format was field tested and found to be appropriate to the needs for a proper stock assessment of sharks and rays. More detailed information on biological aspects such as size at maturity, abundance, dominance, market price and distribution and postharvest utilization are also available.

The reviewed NPOA-Shark (Plan 2) has been improved and completed and is ready to be printed for implementation. The training modules were adequate to increase understanding of issues and will be used for future with the trained personnel available for data collection at other sites. The Department of Fisheries Malaysia will use the same modules to train more officers. Materials for public awareness in the different major local languages (Malay, Chinese, Indian) were found to be very helpful in educating the community on the conservation and management of sharks and rays. The Department of Fisheries Malaysia will print more of the posters for distribution to other states in the country. These posters were also posted at different public places such as schools, fishing jetties and coffee outlets.

Recommendations

- It is suggested that DoFM adopt the data collection format developed under this project to be expanded to other states in the country so as to enable a proper nationwide stock assessment be carried out for sharks and rays.

- One finding of the pilot project is the practice of landing sharks and rays juveniles and sold at very low price. It is suggested for DoFM hold a series of dialogues with skippers and boat owners in order to address this issue where juveniles should be released.

- Another finding of the pilot project is that zone B boats operating under the current 5 nm zone were catching juveniles. Even though the implementation of the new zonation system of extending the zone B boats operating beyond the 8 nm, there is still the possibility of juveniles to be caught unless strict enforcement is carried out to ensure the boats are operating within the defined zone.

- The DoFM is suggested to make use of the materials developed under this project for further awareness campaigns on conservation and management of shark and rays in the country.

Annex 1

FINAL REPORT

DATA COLLECTION

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1.0 INTRODUCTION

Malaysia is a home to a rich diversity of sharks, rays, skate and chimaeras (Class Chondrichthyes). However, sharks and rays landings contribute only about 1% and 2% of total marine landings respectively. Research conducted in freshwater, estuarine and the Economic Exclusive Zone of Malaysia recorded 146 species of Chondrichthyans comprising 63 sharks, 78 rays, four skates and one chimaeras, belonging to 18 families of sharks, 13 rays, one skates and one chimaeras. The high diversity of sharks was recorded from the Order Carcharhiniformes with 45 species and Orectolobiformes with nine species. However, low diversity was recorded for the Orders, Lamniformes, Hexanchiformes and Squatiniformes respectively where only two species were recorded from each order. Species diversity in the Orders Squatiniformes and Heterodontiformes was scanty where only one species was recorded from each Order. As for batoids, high diversity was recorded for the Order Myliobatiformes with 56 species followed by Rhinobatiformes and Torpediniformes with nine species respectively. Only five species were recorded from the Order Rajiformes and three species from Pristiformes. Even though the number of chondrichthyans species recorded in Malaysia was more than 140, the actual status of its biodiversity is still unknown. With new species continuously discovered, the number is expected to increase in the future. At present the deep water species are mostly unknown due to limited research activity. Most sharks and rays species landed especially from the Families Carcharhinidae and Dasyatidae and are very difficult to identify up to species level by untrained and inexperienced enumerators. Only trained staff will be better able to make the right and valid identification of species (Ahmad and Annie Lim, 2012).

Malaysia has been implementing a National Plan of Action for the conservation and management sharks (NPOA-sharks) since 2006. It was mentioned in the Plan that, data recording on sharks and rays will be improved from generic terms 'sharks' and 'rays' to species level. The limited knowledge of the biology and taxonomy of shark species and lack of manpower to undertake data collection up to species level is one of the issues in implementing the Plan.

The Regional Workshop on the Development of the Regional Management Plan (RPOA) for Sharks in the BOBLME Region held in Male, Maldives from 5-7 July 2011, also recommended that countries should identify several landing sites as pilot project to collect and report catch data by species. In order to address the need to record landing data up to species level and to create awareness on sharks and rays conservation among stake holders, the Food and Agriculture Organization of the United Nations (FAO) through BOBLME had agreed to fund a one-year pilot project in Malaysia. A letter of agreement to that effect was signed between Malaysia and FAO granting support of US$25,000 through the Marine Fishery Resources Development and Management Department, Southeast Asian Fisheries Development Centre (SEAFDEC/MFRDMD) for conducting a one-year activity starting January 2013.

1.1 Objective

The objectives of this project were:

- to enhance human resource development in elasmobranch taxonomy, and
- to improve landing data recording from generic 'sharks' and 'rays' to species level.

In order to achieve these objectives, a training course on sharks and rays identification and its biology was conducted. Sixteen participants were trained in the appropriate techniques in recording the morphometric and meristic data as well as in collecting and preserving specimens.

1.2 Activities

1.2.1 Training on Elasmobranchs Taxonomy

Sixteen personals from the Department of Fisheries Malaysia that have been actively involved in data collection participated in a five-day training program. Three lecturers were invited to conduct the training. They were Mr. Ahmad bin Ali, a Senior Research and Regional Vice Chair IUCN Sharks Specialist Group for Southeast Asian Region, Mr. Abdul Haris Hilmi bin Ahmad Arshad, a Senior Research of Fisheries Research Institute and a member of IUCN Sharks Specialist Group for Southeast Asian Region and Mrs. Annie Lim Pek Khiok, a senior laboratory assistant and a member of IUCN Sharks Specialist Group for Southeast Asian Region. The training was started on the first day with three lectures entitled (i) NPOA-Sharks Malaysia, (ii) Introduction to taxonomy and biology of elasmobranchs and (iii) Status of sharks and rays in Malaysian fisheries. On the second and third day, participants were guided to identify fresh specimens of 12 species of sharks and 17 species of rays. On the fourth day, participants were split into four groups. Each group was given different species of sharks and rays to be identified. The participants in each group were then guided by lecturers to identify all specimens and presented the outcome of their work for comments and discussion. Finally on the fifth day, participants were tested on their knowledge in the identification and biology. Based on the result, participants showed improvement in their knowledge on elasmobranchs taxonomy and biology. Specimens used during the training are now preserved at SEAFDEC/MFRDMD depository in Terengganu for future reference. The list of participants is shown in **Table 1** and time table in **Appendix I**.

Table 1: List of Participants

No.	Name	Address
1.	Mr. Zul Bahri bin Rajab	State Fisheries Perlis
2.	Mr. Rajendran A/L Ramasamy	State Fisheries Perak
3.	Mr. Norfaizal Azli bin Mat Nor	SEAFDEC/MFRDMD
4.	Mr. Nazri bin Rajab	State Fisheries Negeri Sembilan
5.	Ms. Azizah bin Ibrahim	State Fisheries Melaka
6.	Mr. Azwan bin Mohamad	State Fisheries Johor
7.	Mr. Mohd Hafizal bin Mustapha	State Fisheries Pahang
8.	Mr. Mohd Zaifreen bin Md Zain	State Fisheries Pahang
9.	Mr. Mohamad Azahari bin Awi	State Fisheries Terengganu
10.	Mr. Azeze bin Salleh	State Fisheries Terengganu
11.	Mr. Faizul Anuar bin Ngah	State Fisheries Terengganu
12.	Mr. Ruzelan bin Jusoh	SEAFDEC/MFRDMD
13.	Mr Adam Luke Anak Pugas	SEAFDEC/MFRDMD
14.	Ms. Norida binti Mohamad Noor	SEAFDEC/MFRDMD
15.	Mrs. Nik Zuraini binti Nawawi	SEAFDEC/MFRDMD
16.	Mr. Khairul Harimee bin Md Nasir	DoF Malaysia, Putrajaya

1.2.2 Data Collection at Landing Sites

1.2.2.1 Selection of Study Sites

The State of Perak in the west coast of Peninsular Malaysia is a major landing state for sharks and rays. Three districts facing the Straits of Malacca, namely Larut Matang, Manjung Selatan and Hilir Perak were selected as the study sites as they were the main landing sites of sharks and rays in the state. The landing data were collected at 11 jetties i.e five in Larut Matang, four in Manjung and two in Hilir Perak. The landing sites are private enterprises with most of the sharks and rays landing coming from trawlers. The location of all landing sites are shown in **Figure 1**.

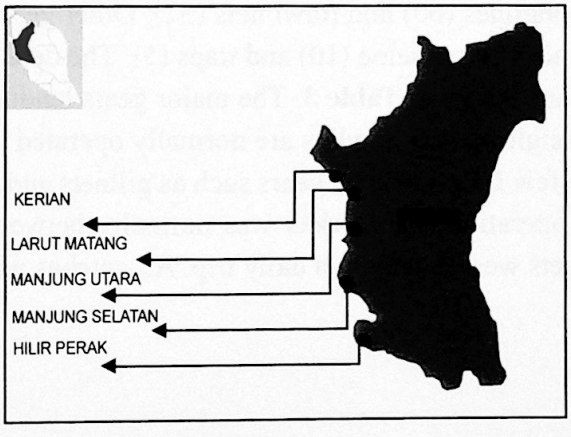

Figure 1: Location of Study Sites in the State of Perak

1.2.2.2 Fishery Structure and Background of Study Sites

1.2.2.3 Hilir Perak

Hilir Perak is one of the major landing sites for sharks and rays in Perak. All jetties belong to private enterprises. The major gears were trawl nets (543), followed by gill nets (441) and purse seine (52). All trawlers are normally operated by 4 - 5 crew members. Almost all of the sharks and rays were landed by trawlers and purse seine operating beyond five nautical miles from the coastline. Fishing operation normally between 5 - 12 day per trip. All catches were landed from 0600hr - 1000hr. The details of fishing vessels registered in this district are shown in **Table 2**.

Table 2: Number of Licensed Fishing Vessels by Gears and Number of Fishers at Hilir Perak

Gear Type	Fishing Zone	Fishing operation (from coastline)	No. of Boat	No. of Fishers
Trawlers				
10 – 24.9 GRT	B	> 5 miles	120	240
25 – 39.9 GRT	B	> 5 miles	108	216
40 – 69.9 GRT	C	> 12 miles	226	904
> 70 GRT	C2	> 30 miles	89	445
Total			**543**	**1,805**
Purse Seiners				
40 – 69.9 GRT	C	> 12 miles	19	345
> 70 GRT	C2	> 30 miles	33	660
Total			**52**	**1,005**
Gill Nets	**A**	All areas	**441**	**882**
Grand Total			**1,036**	**3,692**

1.2.2.4 Manjung Selatan

All jetties in Manjung Selatan belong to private enterprises. The major gears were gill nets (531), followed by longlines (60) and trawl nets (52). Other gears were purse seine (51) bottom gill nets (14), anchovy purse seine (10) and traps (5). The details of the fishing vessels registered in this district are shown in **Table 3**. The major gears landing sharks and rays were trawl nets, gill nets and longlines. All trawlers are normally operated by 4 - 5 crew members. However, the number of crew for traditional gears such as gillnets and longlines was normally 2-3 fishers. The fishing operation for trawlers was normally between 5 - 12 days per trip while longlines and gill nets were normally a daily trip. All catches were landed from 0730hr - 1200hr.

Table 3: Number of Licensed Fishing Vessels by Gears and Number of Fishers at Manjung Selatan

Gear Type	Fishing Zone	Fishing operation (from coastline)	No. of Boat	No. of Fishers
Trawlers				
10 – 24.9 GRT	B	> 5 miles	7	21
25 – 39.9 GRT	B	> 5 miles	28	112
40 – 69.9 GRT	C	> 12 miles	17	85
Total			**52**	**218**
Purse Seiners				
40 – 69.9 GRT	C	> 12 miles	45	730
> 70 GRT	C2	> 30 miles	6	108
Total			**51**	**838**
Purse Seiners (Anchovy)	A	All areas	**10**	**180**
Gill Nets	A	All areas	**531**	**575**
Longlines	A	All areas	**60**	**127**
Traps	A	All areas	**5**	**10**
Bottom Gill Nets	A	All areas	**14**	**42**
Grand Total			**723**	**1,990**

1.2.2.5 Larut Matang

Similar to Manjung Selatan and Hilir Perak, all jetties at Larut Matang also belong to private enterprises. The major gears were trawl nets (519), followed by gill nets (50), purse seines, traps (30) and longlines (10). The details of the fishing vessels registered in this district are shown in **Table 4**. The major gears landing sharks and rays were trawl nets, gill nets and longlines. All trawlers are normally operated by 4 - 5 crew members while traditional gears such as gill nets and longlines were operated by 2 - 3 fishers. Fishing operations for trawlers were normally 5 - 8 days per trip while longlines and gill nets were normally a daily trip. All catches were landed from 0730hr - 1000hr.

Table 4: Number of Licensed Fishing Vessels by Gears and Number of Fishers at Larut Matang

Gear Type	Fishing Zone	Fishing operation (from coastline)	No. of Boat	No. of Fishers
Trawlers				
10 – 24.9 GRT	B	> 5 miles	340	680
25 – 39.9 GRT	B	> 5 miles	30	70
40 – 69.9 GRT	C	> 12 miles	140	450
> 70 GRT	C2	> 30 miles	9	45
Total			**519**	**1,245**
Purse Seiners				
> 70 GRT	C2	> 30 miles	**30**	**750**
Gill Nets	A	All areas	**50**	**80**
Longlines	A	All areas	**10**	**10**
Traps	A	All areas	**30**	**50**
Grand Total			**639**	**2,135**

1.3 Appointment of Enumerators

Three Assistant Fisheries Officers from the State Fisheries Office of Perak were appointed as enumerators. Their names and addresses are as follows:

i. Mr. Abdul Rahman bin Haji Ali Hasan
Pejabat Perikanan Daerah Taiping
Tingkat 6, Wisma Persekutuan, Jalan Istana Larut
34000 Taiping, Perak.

ii. Mr. Abdul Aziz bin Idris
Pejabat Perikanan Daerah Manjung
Tingkat 1, Bangunan Persekutuan
32040 Seri Manjung
Perak Darul Ridzuan

iii. Mr. Mohd Ruslan bin Jusoh
Pejabat Perikanan Daerah Hilir Perak
Tingkat 1, Bangunan Persekutuan, Jalan Changkat Jong
36000 Teluk Intan, Perak.

1.4 Materials and Methods

1.4.1 Sampling Methods

The sampling activity started in January 2013 until 31 December 2013. All enumerators were requested to record landing data and other related information in a standard form at least 3 days/week or 12 days/month. A standard form entitled 'Pilot Data Collection Project on Sharks and Rays (BOBLME)' was produced. The content included Standard Operation Procedure and instructions to enumerators on how to measure, weigh, record sharks and rays species at sampling sites, name of enumerator, name of landing site, date of sampling, vessel registration number, vessel GRT, fishing area, price at landing sites, name of species (common name and scientific name), total catch of sharks, rays, trash fish and commercial fish from each sampling vessel. The details of the standard form are shown in **Appendix II**. The completed forms were then submitted to SEAFDEC/MFRDMD at the end of each month for verification. The data were analysed at the end of each quarter.

1.4.2 Selection of Fishing Vessels and Sampling Activities

Between 1 - 3 fishing vessels were selected for sampling each day for 12 days per month at each landing site. Measurement of Total length (TL) were taken for all sharks species and rays from the Families Rhynchobatidae, Rhinobatidae and Narcinidae. While Disc Length (DL) were taken for all ray species where the tail is frequently absent or damaged (mainly from the Families Dasyatidae, Gymnuridae and Mobulidae). All sharks and rays specimens were measured and weighed individually if the total number was less than 50 tails per vessel. If the total number was more than 50 tails, only 10-50% were measured. The maturity stage for each individual was estimated according to Yano *et al.* (2005) and Ahmad and Annie Lim (2012). The total catch of all sharks and rays by species as well as the total catch of commercial and trash fish were also recorded for each sampling vessel. Some samples were brought back to the Fisheries Research Institute Kg. Acheh and preserved for future reference. Larger specimens were photographed, and their basic taxonomic and biological characteristics noted.

1.4.3 Classification

The classification (scientific names) used in this report follows that of Compagno (1999), Yano *et al.* (2005), Ahmad and Annie Lim (2012), Ahmad *et al.* (2013) and Ahmad *et al.* (2014), and Ebert *et al.* (2013).

2.0 RESULTS

2.1 Hilir Perak

2.1.1 Landing Samples

A total of 218 landings were sampled during the study period. The highest by month was 24 in November followed by 23 in May and September respectively. The highest by gear type was 70 of Zone C2 followed by 63 of Zone C, and 53 of Zone B trawl nets. The details are shown in **Table 5**.

Table 5: Number of Landings Sampled During the Study at Hilir Perak

Type of Gear	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	Total
Purse seine Zone C						2			2				**4**
Purse seine Zone C2	1	3			1	3	3	3	5	1	4	4	**28**
Trawl nets Zone B		1	2	4	6	8	8	6	8	4	6		**53**
Trawl nets Zone C	3	6	7	10	10		5	5	4	2	5	6	**63**
Trawl nets Zone C2	3	2	4	6	6	9	4	4	4	13	9	6	**70**
Total	**7**	**12**	**13**	**20**	**23**	**22**	**20**	**18**	**23**	**20**	**24**	**16**	**218**

2.1.2 Fishing Ground and Catch Composition by Gear Type

The main gear landing sharks and rays was the trawl net at 28,526 kg (96.5%) comprising 19,710 kg rays and 8,816 kg sharks. While purse seines contributed 812 kg (2.7%) of rays and 218 kg (0.8%) of sharks. Most trawlers operated beyond 12 nautical miles from the coastline (in Zone C). A total of 10,129 kg of rays was landed by Zone C2 trawl nets which operated beyond 30 nautical miles from the coastline followed by Zone C trawl nets at 8,959 kg. As for sharks, Zone C2 trawl nets also landed the highest at 4,170 kg followed by Zone C trawl nets at 3,700 kg. The highest landing of rays by month was from Zone C2 trawl nets at 1,508 kg in October while 1,279 kg and 133 kg were from Zone C and Zone B in March respectively. However, the highest landing of sharks by month came from Zone C2 and Zone C trawl nets in February at 822 kg and 1426 kg respectively. For Zone B trawl nets, the highest was in November at 208 kg.The details are shown in **Table 6**.

Table 6: Weight of Sharks and Rays (in kg) Caught by Different Types of Gear

Type of Gear	Month												Grand Total
	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec	
Purse seine Zone C						101.0			323.6				424.6
Purse seine Zone C2		28.0			2.2	150.0	0.8	0.8	200.5	0.5	1.7	3.4	387.8
Trawl nets Zone B			132.5	39.4	26.3	111.4	63.9	60.7	64.2	31.9	91.5		621.8
Trawl nets Zone C	929.0	593.0	1279.5	1126.0	1013.2		383.6	760.8	833.0	485.0	739.1	817.0	8,959.2
Trawl nets Zone C2	952.0	135.0	719.0	380.6	848.1	1414.7	619.0	728.5	1041.0	1507.9	1209.9	573.5	10,129.1
Total catch ray	**1881.0**	**756.0**	**2131.0**	**1545.9**	**1889.8**	**1777.1**	**1067.3**	**1550.7**	**2462.3**	**2025.2**	**2042.3**	**1393.9**	**20,522.4**
Purse seine Zone C						45.7			34.0				79.7
Purse seine Zone C2	10.0	58.0			2.4	41.5	6.2	1.0	15.0			4.0	138.1
Trawl nets Zone B		32.0	32.0	9.1	72.1	188.5	153.6	144.6	97.0	9.5	208.0		946.4
Trawl nets Zone C	121.0	1426.0	305.8	343.9	263.1		332.3	233.1	184.5	98.0	183.0	209.5	3,700.1
Trawl nets Zone C2	187.0	822.0	92.0	443.6	320.1	566.0	430.5	156.3	196.5	394.0	369.5	192.0	4,169.5
Total catch shark	**318.0**	**2338.0**	**429.8**	**796.6**	**657.7**	**841.7**	**922.6**	**535.0**	**527.0**	**501.5**	**760.5**	**405.5**	**9033.8**
Grand Total	**2199.0**	**3094.0**	**2560.8**	**2342.5**	**2547.5**	**2618.8**	**1989.8**	**2085.7**	**2989.3**	**2526.7**	**2802.8**	**1799.4**	**29556.2**

2.1.3 Sharks and Rays Composition

A total of 1,231,904 kg of fish was landed from 218 landings during the study period. Rays and sharks made up 20,522 kg and 9,034 kg (1.7% and 0.7%) from the total landing respectively. While landings of commercial and trash fish were 832,805 kg and 369,543 kg or 67.6% and 30% respectively. Average landings per month for sharks and rays were 753 kg and 1,710 kg respectively. The highest landing by month for rays was 2,462 kg in September, followed by 2,131 kg in March and 2,042 kg in November. However, the highest landing for sharks was 2,338 kg in February followed by 923 kg in July and 841 kg in June. In general, the landing of sharks and rays ranged between 0.4 - 3.4% and 1.0 - 3.2% respectively from total landing. The details are shown in **Table 7**.

Table 7: Catch Composition of Sharks, Rays, Commercial and Trash Fish by Month from 218 Landings at Hilir Perak. All Weights in Kilogram.

Month	Weight								
	Weight of Ray	% Ray	Weight of Shark	% Shark	Weight of Com.	% Com	Weight of Trash	% Trash	Total Catch
Jan	1,881.0	3.2	318.0	0.5	40,406	68.2	16,657	28.1	59,262.0
Feb	756.0	1.1	2338.0	3.4	45,630	66.0	20,367	29.5	69,091.0
Mar	2131.0	2.0	429.8	0.4	75,396	69.5	30,465	28.1	108,421.8
April	1,545.9	1.4	796.6	0.7	69,397	61.8	40,643	36.2	112,382.5
May	1,889.8	1.8	657.7	0.6	69,613	65.5	34,162	32.1	106,322.5
June	1,777.1	1.8	841.7	0.9	66,713	68.0	28,814	29.4	98,145.8
July	1,067.3	1.0	922.6	0.9	75,629	73.2	25,694	24.9	103,312.8
Aug	1,550.7	1.6	535.0	0.6	67,267	69.9	26,886	27.9	96,238.73
Sept	2,462.3	2.3	527.0	0.5	71,918	67.3	31,970	29.9	106,877.3
Oct	2,025.2	1.8	501.5	0.4	78,400	68.0	34,295	29.8	115,221.7
Nov	2,042.3	1.4	760.5	0.5	103,045	68.2	45,180	29.9	151,027.8
Dec	1,393.9	1.3	405.5	0.4	69,391	65.7	34,410	32.6	105,600.4
Total	**20,522.4**		**9,033.8**		**832,805**		**369,543**		**1,231,904.2**
Ave	1,710.2	1.7	752.8	0.7	69,400.4	67.6	30,795.3	30	102658.7

2.1.4 Sample Size

A total of 4,921 tails belonging to 3,094 rays and 1,827 sharks were sampled comprising nine species of rays and 10 species of sharks. The most abundant ray species were *Himantura gerrardi* followed by *Dasyatis zugei* and *Himantura walga*. The highest number of rays sampled by month was 378 in May followed by 342 in November and 312 in June. The most abundant shark species were *Chiloscyllium punctatum* followed by *Chiloscyllium hasseltii* and *Scoliodon laticaudus*. However, the highest number of sharks sampled by month was 230 in November, followed by 227 in June and 205 in September. The most common ray species were *Himantura gerrardi* followed by *Dasyatis zugei* and *Neotrygon kuhlii*. The most

common shark species were *Chiloscyllium punctatum* and *Chiloscyllium hasseltii*. All these species were landed throughout the year. Other species such as *Dasyatis fluviorum, Himantura uarnacoides, Gymnura poecilura, Rhinobatus formosensis, Atelomycterus marmoratus, Carcharhinus leucas, Chiloscyllium indicum, Chiloscyllium plagiosum, Sphyrna lewini* and *Rhizoprionodon acutus*, were rarely landed and only landed between 1 - 3 months during the study period. The details are as shown in **Table 8**.

Table 8: Sample Size of Sharks and Rays by Species

Species	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	Total
Dasyatis fluviorum			1										1
Dasyatis zugei	41	38	36	62	110	80	91	58	86	97	93	91	883
Gymnura poecilura				9					2	2			13
Himantura gerrardi	47	48	105	95	125	107	59	53	80	83	132	93	1027
Himantura uarnacoides										1			1
Himantura walga			12	40	70	72	56	81	90	69	81	28	599
Neotrygon kuhlii	48	39	48	67	73	48	48	24	48	34	23	31	531
Rhinobatus formosensis				3							11		14
Rhynchobatus australiae	2	1	8			5		1		2	2	3	24
Total Rays	**138**	**126**	**210**	**276**	**378**	**312**	**254**	**217**	**306**	**288**	**342**	**246**	**3094**
Atelomycterus marmoratus		1			1						4		6
Carcharhinus leucas		1	3										4
Carcharhinus sorrah	3	31		3	18	35	26	5	12	7	1	1	142
Chiloscyllium hasseltii	25	6	22	12	29	15	31	31	28	50	74	13	336
Chiloscyllium indicum											8		8
Chiloscyllium plagiosum		7							8				15
Chiloscyllium punctatum	42	33	52	77	119	142	97	102	133	85	127	93	1102
Rhizoprionodon acutus			8										8
Scoliodon laticaudus				32	32	35	48	16	24		16		203
Sphyrna lewini				2	1		1						4
Total Sharks	**70**	**79**	**85**	**126**	**200**	**227**	**203**	**154**	**205**	**142**	**230**	**107**	**1827**
Grand Total	**208**	**205**	**295**	**402**	**578**	**539**	**457**	**371**	**511**	**430**	**572**	**353**	**4921**

2.1.5 Weight of Sharks and Rays by Species

A total of 29,556 kg was landed from 218 landings comprising 20,522 kg rays and 9,033 kg sharks. For rays, the highest landing by weight was from species *Himantura gerrardi* amounting to 12,311 kg, followed by 4,736 kg *Neotrygon kuhlii* and 2,637 kg *Dasyatis zugei*. The highest landing by month was 1,652 kg for *Himantura gerrardi* in September, followed by 1,394 kg in November and 1,287 kg in June. For *Neotrygon kuhlii*, the highest landing was 914 kg in January, followed by 600 kg in March and 536 kg in September. For *Dasyatis zugei*, the highest landing was 362 kg in November followed by 336 kg in January and 310 kg in March. Weight of other species ranged between 3.8 kg – 665 kg. The highest landing of

shark species were 4,005 kg for *Chiloscyllium punctatum* followed by 2,573 kg for *Carcharhinus sorrah* and 1,630 kg for *Scoliodon laticaudus*. The highest landing by month for *Chiloscyllium punctatum* was 572 kg in November followed by 492 kg in June and 418 kg in October. For *Carcharhinus sorrah*, the highest landing was 2,076 kg in February followed by 188 kg in July and 84 kg in May. Weight of other species ranged between 2.5 kg - 473 kg. The details are shown in **Table 9**.

Table 9: Weight of Sharks and Rays (in Kg) by Species from 218 Landings at Hilir Perak

Species	J	F	M	A	M	J	J	A	S	O	N	D	Total
Dasyatis fluviorum			3.8										3.8
Dasyatis zugei	336	37.5	310.0	172.0	248.7	145.2	168.2	162.4	171.0	263.6	361.9	260.5	2636.9
Gymnura poecilura				12.1					1.7	0.2			14.0
Himantura gerrardi	610	473.5	1148.2	889.9	1060.1	1287.4	582.8	944.7	1652.0	1268.0	1393.5	1001.0	12311.1
Himantura uarnacoides										3.4			3.4
Himantura walga			9.5	103.0	73.4	46.2	31.3	99.0	101.6	63.0	116.5	21.0	664.5
Neotrygon kuhlii	914	221.0	600.0	365.2	507.6	288.0	285.0	342.0	536.0	421.0	155.5	101.0	4736.3
Rhinobatus formosensis				3.8							10.2		14.0
Rhynchobatus australiae	21	24.0	59.5			10.3		2.6		6.0	4.6	10.5	138.5
Total weight rays	**1,881**	**756.0**	**2,131.0**	**1,545.9**	**1,889.8**	**1,777.1**	**1067.3**	**1,550.7**	**2,462.3**	**2,025.2**	**2,042.3**	**1,393.9**	**20,522.4**
Atelomycterus marmoratus		0.5			0.5						2.0		3.0
Carcharhinus leucas		91.0	200.4										291.4
Carcharhinus sorrah	3	2076.0		24.9	83.8	61.9	188.2	34.8	53.5	40.0	3.5	4.0	2573.6
Chiloscyllium hasseltii	40.8	8.5	49.0	14.0	38.1	23.0	24.6	59.2	42.0	43.5	106.0	24.5	473.2
Chiloscyllium indicum											12.0		12.0
Chiloscyllium plagiosum		17.0							1.5				18.5
Chiloscyllium punctatum	274.2	145.1	155.9	181.4	312.7	491.7	323.1	392.0	362.0	418.0	572.0	377.0	4005.1
Rhizoprionodon acutus			24.5										24.5
Scoliodonla laticaudus				575.0	222.0	265.1	386.0	49.0	68.0		65.0		1630.1
Sphyrna lewini				1.3	0.6		0.7						2.5
Total weigh sharks	**318**	**2,338.0**	**429.8**	**796.6**	**657.7**	**841.7**	**922.6**	**535.0**	**527.0**	**501.5**	**760.5**	**405.5**	**9033.8**
Grand Total	**2,199**	**3094.0**	**2,560.8**	**2,342.5**	**2,547.5**	**2,618.8**	**1989.8**	**2,085.7**	**2,989.3**	**2,526.7**	**2,802.8**	**1,799.4**	**29,556.2**

2.1.6 Size Range of Sharks and Rays

In general most ray species sampled from January to June were mature except for *Himantura gerrardi, Rhynchobatus australiae* and *Gymnura poecilura*. The average size of *Himantura gerrardi* ranged between 311- 408 mm disc length but no adult sized specimens were available (immediately removed by middlemen upon being landed). First maturing size for *Himantura gerrardi* is about 590 mm and for *Gymnura poecilura* about 450 mm disc length. It could be inferred that most of these species were exploited at the juvenile stage. However, almost all of *Dasyatis zugei, Neotrygon kuhlii, Dasyatis fluviorum* and *Rhinobatus formosensis* were mature. Most shark species landed were mature except for *Rhizoprionodon acutus* and *Sphyrna lewini*. First maturing size for these species are 750 mm and 1,400 mm total length respectively. It could be inferred that all *Carcharhinus sorrah* landed was juvenile except in February and April. First maturing size for *Carcharhinus sorrah* is 900 mm total length. Size range of all sharks and rays species from January to June are shown in **Table 10A.**

Most ray species landed from July to December were mature except for *Himantura gerrardi, Gymnura poecilura, Himantura uarnacoides* and *Rhynchobatus australiae*. Similar to the first six months of 2013, almost all of these species were juvenile except for *Dasyatis zugei, Neotrygon kuhlii, Himantura walga* and *Rhinobatus formosensis*. Most shark species were mature except for *Chiloscyllium plagiosum* and *Sphyrna lewini*. First maturing size for these species are 500 mm and 1400 mm total length respectively. All *Carcharhinus sorah* landed was juvenile except those landed in July, August and October. Size range of all sharks and rays species from July to December are shown in **Table 10B**.

Table 10A: Size Range of Sharks (Total Length) and Rays (Disc Length) Except for *Rhinobatus formosensis* and *Rhynchobatus australiae* (Total Length) from January to June. All Measurements in Millimeter

Species	Month																	
	Jan			Feb			Mar			April			May			June		
	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
Rays																		
D. fluviorum							420	420	420									
D. zugei	140	260	204.4	160	240	191.2	180	320	242.8	140	260	199.5	120	230	183.9	135	235	187.2
G. poecilura										100	410	201.1						
H. gerrardi	180	580	362.8	220	780	408.1	190	770	387.9	120	700	345.9	150	510	310.9	185	540	316.7
H. walga							180	260	208.8	150	230	186	100	220	163.9	120	225	170.7
N. kuhlii	140	300	212.9	140	310	222.3	150	330	244.8	130	260	195.4	140	280	197	132	245	197.8
R. formosensis										630	820	713.3						
R. australiae	590	1620	1105	1850	1850	1850	630	1950	923.8							640	930	780
Sharks																		
A. marmoratus				520	520	520							620	620	620			
C. leucas				2140	2140	2140	690	2100	1490									
C. sorrah	530	680	620	630	1400	899.4				730	1240	986.7	445	1155	621.9	430	932	647.6
C.hasseltii	490	730	589.2	520	630	580	450	780	646.8	480	770	610	410	790	641.4	440	785	666.3
C. plagiosum				520	660	585.7												
C. punctatum	280	870	681.9	460	780	651.8	530	880	698.7	120	880	691.2	490	870	715.2	445	890	702.1
R. acutus							250	420	327.5									
S. laticaudus										230	510	372.5	245	495	331.2	290	435	352.3
S. lewini										470	490	480	460	460	460			

Table 10B: Size Range of Sharks (Total Length) and Rays (Disc Length) Except for *Rhinobatus formosensis* and *Rhynchobatus australiae* (Total Length) from July to December. All Measurements in Millimeter.

Species	Month																	
	July			August			September			October			November			December		
	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
Rays																		
D. zugei	130	250	191.8	140	225	193	142	280	200.1	165	320	217.6	165	312	231.4	180	300	232.6
G. poecilura							140	210	175	130	150	140						
H. gerrardi	185	600	320.5	170	710	379.9	180	610	344.8	190	640	345.3	170	670	352.5	190	670	343.4
H. uarnacoides										370	370	370						
H. walga	120	215	170.6	120	220	179.2	125	225	181.9	120	230	189.6	120	245	192.5	175	240	204.8
N. kuhlii	160	240	195	160	230	193.9	135	240	202.4	180	290	214	180	245	218.1	188	280	221.5
R. formosensis													550	752	651.1			
R. australiae				840	840	840				840	920	880	585	910	747.5	880	925	895
Sharks																		
A. marmoratus													400	540	500			
C. sorrah	650	1470	969.4	630	1430	955	590	960	777.7	690	1440	897.9	860	860	860	890	890	890
C.hasseltii	310	772	497.1	345	780	634.9	495	792	710.3	210	790	431.7	200	790	581	630	790	727.7
C. indicum													450	600	548.8			
C. plagiosum							290	410	366.9									
C. punctatum	465	840	678.5	390	820	661.3	295	880	640.2	490	890	713	480	905	720.5	490	882	718.8
S. laticaudus	285	440	360.9	310	410	368.1	280	430	352.1				330	480	416.6			
S. lewini	490	490	490															

2.1.7 Usage and Marketing

Information on marketing collected at this landing site indicated that most sharks and rays were consumed locally and some were exported to Singapore. The major markets were wholesale market in Selayang, and other major towns in Perak, Johor, Penang and Selangor. The price varied according to species. The most expensive ray *Himantura gerrardi* was sold at RM12-14/kg followed by *Neotrygon kuhlii* and *Rhynchobatus australiae* at RM8-10/kg. The cheapest rays were *Dasyatis zugei* and *Rhinobatus formosensis* sold at RM2-3/kg and RM2-2.50/kg respectively. In general, bigger sized rays were more expensive than smaller ones.

Small sized sharks with total length of less than 20 cm were sold locally at RM1-1.5/kg. The most expensive sharks *Carcharhinus leucas* was sold at RM25-30/kg, *Carcharhinus sorrah* at RM10-14/kg and *Sphyrna lewini* at RM8-10/kg. Market destinations for sharks and rays were similar. However, some species such as *Chiloscyllium hasselti, Chiloscyllium plagiosum* and *Chiloscyllium punctatum* were sold to buyers in Penang where they are mainly used in traditional Indian cuisine.

Normally the price at wet markets was about 20-50% higher than at landing site. The price was almost consistent for the whole year for all species but can sometimes fluctuate up to 50% when supply was limited; especially for *Himantura gerarrdi, Rhynchobatus australiae, Carcharhinus sorrah* and *Carcharhinus leucas*. Fins of adult *Rhynchobatus australiae* and *Carcharhinus leucas* were sold separately, with the price ranging between RM100 - 200/kg and RM70 - RM150 respectively. All sharks and rays were landed whole with fins. The details are shown in **Table 11**.

Table 11: Price of Sharks and Rays by Species at Hilir Perak Landing Site in 2013. All Prices in RM per Kilogram. (Exchange rate: RM3.30= US$ 1.00)

Species	RangePrice (RM/kg)	Part	Market Destination
Rays			
D. fluviorum	6-7	Whole body	Teluk Intan
D. zugei	2-3	Whole body	Teluk Intan, Ipoh, Kuala Lumpur, Selangor, Singapore
G. poecilura	3-4	Whole body	Teluk Intan, Ipoh
H. gerrardi	12-14	Whole body	Teluk Intan, Ipoh, Kuala Lumpur, Selangor and Singapore
H. uarnacoides	6-10	Whole body	Teluk Intan
H. walga	2-3	Whole body	Teluk Intan, Ipoh, Kuala Lumpur, Selangor
N. kuhlii	8-10	Whole body	Teluk Intan, Ipoh, Kuala Lumpur, Selangor and Singapore
R. formosensis	2-2.5	Whole body	Teluk Intan, Kuala Lumpur
R. australiae	8-10	Whole body (small	Teluk Intan, Ipoh, Kuala Lumpur,
		size)	Selangor and Singapore

	10-12	meat (big size)	Teluk Intan, Ipoh, Kuala Lumpur, Selangor
	100-200	Wet fin (medium to big size)	Kuala Lumpur, Singapore
Sharks			
A. marmoratus	2-2.5	Whole body	Teluk Intan
C. leucas	25-30	Whole body (small size)	Ipoh, Kuala Lumpur, Selangor
	15-20	meat (big size)	Ipoh, Kuala Lumpur, Selangor
	70-150	Fins (medium to big size)	Kuala Lumpur, Singapore
C. sorrah	10-14	Whole body	Teluk Intan, Ipoh, Kuala Lumpur
	10-15	meat (big size)	Ipoh, Kuala Lumpur, Selangor
	100-150	Fins (medium to big size)	Kuala Lumpur, Singapore
C. hasseltii	2-3	Whole body	Teluk Intan, Ipoh, Kuala Lumpur, Penang
C. indicum	1-1-5	Whole body	Teluk Intan, Ipoh Kuala Lumpur, Penang
C. plagiosum	1-1.5	Whole body	Teluk Intan, Ipoh Kuala Lumpur, Penang
C. punctatum	2-3	Whole body	Teluk Intan, Ipoh Kuala Lumpur, Penang
S. laticaudus	2-4	Whole body	Teluk Intan and other local markets in Perak, Kuala Lumpur
S. lewini	8-10	Whole body	Teluk Intan and other local markets in Perak

2.2 Manjung Selatan

2.2.1 Landing Samples

A total of 292 landings were sampled during the study period. The highest number of vessels sampled by month was 27 in November followed by 26 in March, and 25 in February, April and December respectively. The highest by gear type was the drift nets from 91 vessels comprising 66 small mesh size drift net, 14 three layers drift net, 10 pompret drift net and one big mesh size drift net. While for trawl nets from 97 vessels comprising 53 of Zone B, 42 of Zone C and two of Zone C2. Other gears were 41 longlines, 20 hook and lines and 14 bottom gill nets followed by pull nets, crab traps, intertidal nets, fish traps and purse seines (range 1 – 3 vessels). The details are shown in **Table 12**.

Table 12: Number of Landings Sampled During the Study at Manjung Selatan

Type of Gear	Month												Total
	J	F	M	A	M	J	J	A	S	O	N	D	
Bottom gill net	1	2	3			2	1		2		2	1	14
Coastal pull net								1	1		1		3
Crab trap		1	1						1				3
Drift net (small mesh size)	7	6	10	7	7	5	3	3	2	5	6	5	66
Drift net(pompret)			1		1		1	5	1		1		10
Drift net(big mesh size)							1						1
Drift net(three layers)						1	3	1	2	3	2	2	14
Hook and lines	2	4	1	3	2	3	1		2		2		20
Intertidal net			1	2	1	2			1		3		10
Longlines	4	2	2	2	3	2	2	4	4	5	4	7	41
Fish trap	2				1	2	1		1		2	2	11
Purse seine Zone C								1					1
Purse seine Zone C2								1					1
Trawl net Zone B	5	3	4	6	6	5	6	4	4	7		3	53
Trawl net Zone C	1	7	3	5	3	2	2	3	3	4	4	5	42
Trawl net Zone C2							1	1					2
Total	**22**	**25**	**26**	**25**	**24**	**24**	**22**	**24**	**24**	**24**	**27**	**25**	**292**

2.2.2 Fishing Ground and Catch Composition by Gear Type

The main gear landed sharks and rays was trawl nets with 6,034 kg (63.3%) comprising of 4,530 kg rays and 1,504 kg sharks. Landing from longlines was the second with 1,587 kg (16.9%) of rays and 259 kg (2.8%) of sharks. Most sharks and rays were landed by trawl nets operated beyond 5 nautical miles from coastlines (Zone B). A total of 3,813 kg of rays and 1,283 kg of sharks were landed by Zone C trawl nets followed by Zone B trawl nets with 485 kg rays and 142 kg sharks. Coastal longlines landed 1,587 kg of rays and 259 kg of sharks. Other gears contributed only 1,050 kg of rays and 328 kg of sharks. The highest landing of rays from trawl net Zone C was in April (474 kg), trawl net Zone B in January (110 kg) and trawl net Zone C2 at 133 kg.However the highest landing of sharks from trawl net Zone C was in March (172 kg) and longlines in August at 76 kg The detail are shown in **Table 13**.

Table 13: Weight of Sharks and Rays (in kg) Caught by Different Types of Gear

Type of gear	Month												Grand Total
	Jan	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov	Dec	
Bottom gill net	27.0	13.1	0.8			4.8	1.0		60.7		10.4	0.2	118.0
Coastal pull net								2.8	4.3		3.5		10.6
Crab trap			2.0										2.0
Drift net (small mesh size)	52.0	25.3	43.5	40.3	25.8	16.4	16.2	22.0	7.2	245.0	177.7	34.3	705.6
Drift net (Pomfret)			5.5		8.3		4.6	14.2	3.1		1.0		36.7
Drift net (three layers)						1.4	2.0	2.2		0.1			5.7
Hook and lines	20.0	33.8	16.0	9.7	3.8	11.0	3.5		10.2		20.2		128.2
Intertidal net			4.5	11.0	6.5	10.0			7.6		56.0		95.6
Longlines	247.0	47.0	53.5	21.0	12.7	43.5	15.0	332.0	67.6	588.3	30.2	129.6	1587.4
Portable trap	11.0				6.5	17.0	13.0		10.4		5.0	9.3	72.1
Purse Seine Zone C								4.6					4.6
Purse Seine Zone C2								1.7					1.7
Trawl net Zone B	110.0	68.0	27.3	52.0	39.8	14.4	29.7	7.1	28.8	50.0		58.7	485.8
Trawl net Zone C	135.0	398.2	338.0	473.5	459.0	200.0	190.0	273.8	179.5	396.7	388.6	380.2	3812.5
Trawl net Zone C2							99.0	133.0					232.0
Total catch ray	**602.0**	**585.4**	**491.1**	**607.5**	**562.4**	**318.5**	**374.0**	**793.3**	**379.4**	**1280.1**	**692.5**	**612.2**	**7298.4**
Bottom gill net	12.0	2.6	7.1			10.0	3.4		2.1		12.2	7.0	56.4
Crab trap		2.6	5.0						2.8				10.4
Drift net (small mesh size)	52.8	7.1	11.9	6.8	6.4	1.5	11.8	4.9	6.2	3.2	1.7	7.2	121.5
Drift net (Pomfret)			1.2				0.8	20.0					22.0
Drift net (big mesh							21.0						21.0

size													
Drift net (three layers)						2.1	3.2	2.4	4.1	3.7	3.6	4.3	23.4
Hook and lines	6.0	3.0		6.8	5.7	12.5	2.4		4.9		5.5		46.8
Longlines	29.0	15.2		11.0	16.4	1.0	19.4	75.6	28.2	16.4	34.4	12.6	259.2
Portable trap						15.2	10.3						25.5
Purse Seine Zone C2								0.6					0.6
Trawl net Zone B	17.0	7.5	12.5	34.3	4.3	16.4	7.2	6.1	12.2	2.2		22.3	142.0
Trawl net Zone C	38.0	155.5	75.0	157.0	172.0	38.2	81.3	117.2	103.1	147.0	107.1	92.1	1283.5
Trawl net Zone C2							39.0	39.0					78.0
Total catch shark	**154.8**	**193.5**	**112.7**	**215.9**	**204.8**	**96.9**	**199.8**	**265.8**	**163.6**	**172.5**	**164.5**	**145.5**	**2090.3**
Grand Total	**756.8**	**778.9**	**603.8**	**823.4**	**767.2**	**415.4**	**573.8**	**1059.1**	**543.0**	**1452.7**	**857.0**	**757.7**	**9388.6**

2.2.3 Sharks and Rays Composition

A total of 216,476 kg of fish was landed from 292 landings during the study period. Rays and sharks made up 7,298 kg and 2,090 kg (3.7% and 1.1%) from the total landing respectively. While landings of commercial and trash fish were 144,302 kg and 62,785 kg or 64.6% and 30.7% respectively. Average landings per month for sharks and rays were 174 kg and 608 kg respectively. The highest landing by month for rays was 1,280 kg in October, followed by 793 kg in August and 693 kg in November. However, the highest landing for sharks was 266 kg in August followed by 216 kg in April and 205 kg in May. In general, the landing of sharks and rays ranged between 0.6–2.0% and 2.1 - 3.7% respectively from total landing. The details are shown in **Table 14**.

Table 14: Catch Composition of Sharks, Rays, Commercial and Trash Fish by Month from 292 Landings at Manjung Selatan. All Weights in Kilogram

Month	Weight								
	Weight of Ray	% Ray	Weight of Shark	% Shark	Weight of Com.	% Com	Weight of Trash	% Trash	**Total Catch**
Jan	602.0	7.7	154.8	2.0	3,293.5	42.3	3,730	47.9	**7,780.3**
Feb	585.4	2.1	193.5	0.7	17,515.0	63.9	9,105	33.2	**27,398.9**
Mar	491.1	3.1	112.7	0.7	11,079.0	68.8	4,410	27.4	**16,092.8**
April	607.5	2.5	215.9	0.9	17,156.5	70.1	6,500	26.6	**24,479.9**
May	562.4	4.1	204.8	1.5	7,767.5	57.1	5,080	37.3	**13,614.7**
June	318.5	3.0	96.9	0.9	6,593.0	62.1	3,608	34.0	**10,616.4**
July	374.0	2.5	199.8	1.3	9,253.5	62.2	5,045	33.9	**14,872.3**
Aug	793.3	5.6	265.8	1.9	8,634.0	61.3	4,396	31.2	**14,089.1**
Sept	379.4	2.3	163.6	1.0	10,991.5	68.0	4,631	28.6	**16,165.5**
Oct	1,280.1	5.2	172.5	0.7	15,524.8	62.9	7,689	31.2	**24,666.5**
Nov	692.5	3.3	164.5	0.8	16,485.0	78.5	3,670	17.5	**21,012.0**
Dec	612.2	2.4	145.5	0.6	20,009.0	77.9	4,921	19.2	**25,687.7**
Total	**7,298.4**		**2,090.3**		**144,302.3**		**62,785.0**		**216,476.0**
Ave	608.2	3.7	174.2	1.1	12025.2	64.6	5,232.1	30.7	**18039.7**

2.2.4 Sample Size

A total of 3,704 tails belonging to 2,179 rays and 1,525 sharks were sampled comprising 13 species of rays and eight species of sharks. The most abundant ray species were *Neotrygon kuhlii* followed by *Himantura gerrardi* and *Dasyatis zugei*. The highest number of rays sampled by month was 280 in October followed by 252 in November and 242 in April. The most abundant sharks species were *Chiloscyllium hasseltii* followed by *Chiloscyllium punctatum* and *Atelomycterus marmoratus*. The highest number of sharks sampled by month was 184 in November followed by 176 in August and 158 in December. The common ray species were *Neotrygon kuhlii* followed by *Himantura gerrardi, Dasyatis zugei, Gymnura japonica, Dasyatis fluviorum* and *Himatura walga*. The common shark species were *Chiloscyllium hasseltii* and *Chiloscyllium punctatum*. All these species were landed almost

throughout the year. Other species of rays such as *Himantura granulata, Himantura jenkinsii* and *Pastinachus gracilicaudus* were rarely landed and only landed in one month during the study period. Rarely landed species of sharks were *Carcharhinus melanopterus, Carcharhinus leucas, Carcharhinus sealei* and *Chiloscyllium plagiosum*. These species only landed between 1-2 months during the study period. The details are shown in **Table 15**.

Table 15: Sample Size of Sharks and Rays by Species

	Month												
Species	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**Total**
Dasyatis fluviorum	3	1	12	9	5	5	1	1	4	1	8	3	53
Dasyatis zugei	14	24	19	29	8	12	20	14	8	52	41	43	284
Gymnura japonica	10	6	6	7	13	10	9	5	3	1	3	4	77
Gymnura poecilura										15	15	2	32
Himantura gerrardi	39	43	30	48	45	28	43	60	61	100	64	63	624
Himantura granulata			2										2
Himantura jenkinsii				1									1
Himantura uarnacoides	1	1		1							14		17
Himantura walga	4		2	24	22	10	25	19	19	2	10	18	155
Neotrygon kuhlii	30	56	37	121	65	31	61	88	90	109	76	89	853
Pastinachus gracilicaudus											14		14
Rhynchobatus australiae		2	1		2			1				1	7
Taeniura lymma	8	2	1	2	10	2			16		7	12	60
Total Rays	**109**	**135**	**110**	**242**	**170**	**98**	**159**	**188**	**201**	**280**	**252**	**235**	**2179**
Atelomycterus marmoratus	2			17	23	7	12	22	18	24	19	10	154
Carcharhinus leucas				1								2	3
Carcharhinus melanopterus	1												1
Carcharhinus sealei	7		2										9
Carcharhinus sorrah		2		1	26	7	6	24	10			4	80
Chiloscyllium hasseltii	52	56	50	80	55	59	87	97	97	86	126	108	953
Chiloscyllium plagiosum		10	3										13
Chiloscyllium punctatum		19	10	38	25	15	37	33	26	36	39	34	312
Total Sharks	**62**	**87**	**65**	**137**	**129**	**88**	**142**	**176**	**151**	**146**	**184**	**158**	**1525**
Grand Total	**171**	**222**	**175**	**379**	**299**	**186**	**301**	**364**	**352**	**426**	**436**	**393**	**3704**

2.2.5 Weight of Sharks and Rays by Species

A total of 9,389 kg of elasmobranchs were landed comprising 7,298 kg rays and 2,090 kg sharks. The highest landing by weight of ray species was 3,544 kg for *Himantura gerrardi* followed by 3,037 kg for *Neotrygon kuhlii*. The highest landing by month of *Himantura gerrardi* was 795 kg in October, followed by 511 kg in August and 307 kg in November. For Neotrygon kuhlii, the highest landing was 393 kg in April, followed by 391 kg in October

and 317 kg in February. Landing of other species ranged from 5.2kg - 163 kg. The highest landing of sharks species was 1,046 kg for *Chiloscyllium hasseltii*, 656 kg for *Chiloscyllium punctatum* and 249 kg for *Carcharhinus sorrah*. All these species except *Carcharhinus sorrah* were landed throughout the year. The highest landing for *Chiloscyllium hasseltii* was 112 kg in January followed by 108 kg in February and 107 kg in August. For *Chiloscyllium punctatum*, the highest landing was 110 kg in April followed by 82 kg in July and 76 kg in August. Landings of other species ranged between 3.8 kg - 69.2 kg. The details are shown in **Table 16.**

Table 16: Weight of Sharks and Rays (in kg) by Species from 292 Landings at Manjung Selatan

	Month												
Species	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**Total**
D. fluviorum	9	2.8	19.9	14.7	9.6	11	0.9	2.3	7	1.1	5.3	6.9	90.2
D. zugei	14	10.5	12.3	13	4.2	3.9	4.7	2.1	1.9	47.9	14	35	163
G. japonica	19	8.5	11.8	4.6	22	13	10	10.3	6.2	2.6	6.1	9.3	123
G. poecilura										41.7	13	2.6	56.9
H. gerrardi	286	235	261	161	207	135	216	511	179	795	307	252	3544
H. granulata			5.5										5.5
H. jenkinsii				5.2									5.2
H. uarnacoides	14	4.5		4.8							26		48.9
H. walga	5		2	9.4	9.3	4	11	7.4	5.6	0.5	14	17	84.9
N. kuhlii	245	317	165	393	302	151	131	228	169	391	281	264	3037
P. gracilicaudus											20		20.2
R. australiae		3	13		1.9			32				10	60.1
T. lymma	11	4.3	1.3	1.8	6.5	2			11		6.3	16	59.8
Total weight rays	**602**	**585**	**491**	**608**	**562**	**319**	**374**	**793**	**379**	**1280**	**693**	**612**	**7298**
A. marmoratus	1			7.7	16	2.8	4.6	8.4	8.3	9.2	6.7	4.2	69.2
B. leucas				4								7.2	11.2
C. melanopterus	3.8												3.8
C. sealei	39		9										47.5
D. sorrah		8.5		6.3	73	14	33	74.8	22			18	249
C. hasseltii	112	108	81.1	87.9	73	60	81	107	70	96.7	99	72	1046
C. plagiosum		5	2.2										7.2
C. punctatum		72.2	20.4	110	42	20	82	75.8	64	66.7	59	44	656
Total weight shark	**155**	**194**	**113**	**216**	**205**	**97**	**200**	**266**	**164**	**173**	**165**	**146**	**2090**
Grand Total	**757**	**779**	**604**	**823**	**767**	**415**	**574**	**1059**	**543**	**1453**	**857**	**758**	**9389**

2.2.6 Size Range of Sharks and Rays

In general, most ray species landed from January to June were immature except for *Dasyatis zugei, Himantura walga, Taeniura lymma* and *Neotrygon kuhlii.* The average size of *Taeniura lymma* landed was 200 - 340 mm since its first maturing size is 203 mm disc length. Most *Dasyatis fluviorum* landed in January was mature. The average size of *Dasyatis fluviorum* was between 339 - 520 mm since its first maturing size is 440 mm disc length. First maturing sizes for *Gymnura japonica* is about 450 mm, 550 mm for *Himantura granulata*, 700 mm for *Himantura jenkinsii* and 600 mm disc length for *Himantura uarnacoides*. Adult sized *Himantura gerarrdi* were not readily available because the specimens were immediately removed by middlemen upon being landed.

Almost all sharks such as *Atelomycterus marmoratus, Carcharhinus sealei* and *Chiloscyllium hasseltii* were mature. However, *Chiloscyllium punctatum* was immature except those landed in February and April since its first maturing size is about 680 mm total length. *Chiloscyllium plagiosum* landed in March was also mature. Other species such as *Carcharhinus leucas, Carcharhinus sorrah, Carcharhinus melanopterus* were still immature. Size range of all sharks and rays species from January to June are shown in **Table 17A**.

Only five species of sharks were landed from July to December. Similar to the first six months of 2013, most ray species landed from July - December were still immature except for *Dasyatis zugei, Himantura walga, Taeniura lymma* and *Neotrygon kuhlii.* One specimen of *Rhynchobatus australiae* landed in August was mature. The first maturing size for this species is about 1,300 mm total length. Almost all *Atelomycterus marmoratus* and *Chiloscyllium hasseltii* were mature. However, only *Chiloscyllium punctatum* landed in July and September was mature. Size range of all sharks and rays species from July to December are shown in **Table 17B**.

Table 17A: Size Range of Sharks (Total Length) and Rays (Disc Length) Except for *Rhynchobatus australiae* (Total Length) from January to June. All Measurements in Millimeter

Species	Month																	
	Jan			Feb			March			April			May			June		
	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
Rays																		
D. fluviorum	310	910	520	380	380	380	220	435	338.8	290	390	351.1	280	390	344	300	400	369
D. zugei	140	310	232.1	160	300	217.3	180	270	210.8	160	305	215	210	280	244.4	160	210	187.5
G. japonica	230	350	269	200	280	236.7	230	400	310.8	225	280	252.1	250	410	298.8	170	350	256
H. gerrardi	180	770	441	140	720	393.7	230	800	407.3	170	740	350.8	190	600	369	195	810	400.2
H. granulata							370	390	380									
H. jenkinsii										500	500	500						
H. uarnacoides	830	830	830	360	360	360				565	565	565						
H. walga	180	250	215				220	230	225	160	250	208.5	190	240	210.5	160	220	188.5
N. kuhlii	140	280	221.3	130	370	241.5	160	380	234.7	130	290	221.1	150	310	215.8	160	280	227.9
R. australiae				540	600	570	1290	1290	1290				500	580	540			
T. lymma	220	310	265	330	340	335	335	335	335	275	290	282.5	200	280	253	270	290	280
Sharks																		
A. marmoratus	440	460	450							410	560	465.6	430	510	467.8	490	530	512.9
C. leucas										800	800	800						
C. melanopterus	620	620	620															
C. sealei	650	880	740				840	940	890									
C. sorrah				735	740	737.5				1020	1020	1020	570	650	597.9	570	750	655.7
C. hasseltii	440	780	587.9	350	740	579.8	410	770	590.7	400	780	553.8	460	730	586.9	400	710	593.7
C. plagiosum				460	520	493.0	500	520	510									
C. punctatum				510	820	679.7	310	760	580	490	870	705.5	450	880	635.2	490	670	615.3

Table 17B: Size Range of Sharks (Total Length) and Rays (Disc Length) Except for *Rhynchobatus australiae* (Total Length) from July to December. All Measurements in Millimeter

Species	Month																	
	July			August			Sept			Oct			Nov			Dec		
	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
Rays																		
D. fluviorum	280	280	280	380	380	380	210	450	295	290	290	290	180	300	242.5	230	470	341.7
D. zugei	160	200	179.4	140	260	185.7	140	210	185	160	295	211.1	140	295	206.8	150	270	197.7
G. japonica	125	400	255.8	130	390	300	280	410	333.3	360	360	360	280	360	326.7	280	380	330
G. poecilura										200	460	340.3	140	320	218.7	260	280	270
H. gerrardi	170	620	369.9	180	860	442.3	190	620	387.4	180	850	424.8	180	780	376.6	190	690	383.6
H. uarnacoides													180	450	319.3			
H. walga	170	250	209.8	170	240	223.2	150	250	215.3	170	225	197.5	190	210	203	180	240	205
N. kuhlii	170	310	236.1	120	330	236.6	160	310	246.7	140	330	253.2	150	320	261.3	160	320	256.3
P. gracilicaudus													250	350	303.6			
R. australiae				1780	1780	1780										1119	1119	1119
T. lymma							130	340	241.3				230	320	274.3	250	340	288.3
Sharks																		
A. marmoratus	400	590	485	410	620	500.9	480	530	503.3	430	580	513.3	480	580	512.1	480	540	513
C. leucas																790	790	790
C. sorrah	630	1470	848.3	160	1260	782.5	720	780	745							960	1008	994.8
C. hasseltii	330	720	575.6	470	730	614.1	250	730	512.7	180	730	534	200	730	511.6	250	700	482.4
C. punctatum	270	850	698.1	470	830	650.3	560	860	682.7	440	790	650.6	570	780	654.6	580	730	650

2.2.7 Usage and Marketing

Information on marketing showed that all sharks and rays were consumed locally. The major markets were wholesale markets in Kuala Lumpur, and local markets in Perak such as Ipoh, Sitiawan, Lumut, Kg. Baru and Ayer Tawar. The price varied according to species. The most expensive rays were adult *Himantura gerrardi* at RM15/kg with smaller sized fish sold at only RM5/kg. Other ray species such as *Rhynchobatus australiae, Himantura jenkinsii, Himantura uarnacoides, Gymnura japonica* and *Himantura granulata* were also sold at higher price between RM5 - RM10/kg. Dasyatis zugei and *Himantura walga* were the cheapest and sold at RM1 - RM2/kg. In general, bigger rays were more expensive than smaller ones. Bigger sharks also fetched higher prices than smaller ones. The most expensive sharks *Carcharhinus leucas* was sold at RM25 - RM30/kg followed by *Carcharhinus melanopterus* and *Carcharhinus sorrah* at RM9 - RM10/kg and RM5 - RM11/kg respectively. Marketing destinations for sharks were almost similar as for rays. Fins were sold separately to middlemen in Ipoh and Kuala Lumpur. Small sharks with total length less than 20 cm were sold locally at a price between RM1 - RM1.5/kg. The price at wet markets was about 20-50% higher than at landing site. The price was almost consistent for the whole year for all species but can sometimes fluctuate up to 50% when supply was limited. The details are shown in **Table 18**.

Table 18: Price of Sharks and Rays by Species at Manjung Selatan Landing Site in 2013. All Prices in RM per Kilogram. (Exchange rate: RM3.30= US$1.00)

Species	Range Price (RM/kg)	Part	Market Destination
Rays			
D. fluviorum	3.0-6.5	Whole body	Local market, Ipoh, Kuala Lumpur
D. zugei	1.0-2.0	Whole body	Local market, Ipoh, Kuala Lumpur
G. japonica	5.0-7.0	Whole body	Local market, Ipoh
G. poecilura	5.0-7.0	Whole body	Local market, Ipoh
H. gerrardi	5.0-15.0	Whole body	Local market, Ipoh, Kuala Lumpur
H. granulata	5.0-6.0	Whole body	Local market, Ipoh
H. jenkinsii	9.0-10.0	Whole body	Local market, Ipoh
H. uarnacoides	6.0-7.0	Whole body	Local market, Ipoh, Kuala Lumpur
H. walga	1.0-2.0	Whole body	Local market, Ipoh, Kuala Lumpur
D. kuhlii	4.0-8.0	Whole body	Local market, Ipoh, Kuala Lumpur
P. gracilicaudus	7-8	Whole body	Local market, Ipoh, Kuala Lumpur
R. australiae	11.0-13.0	Whole body	Local market, Ipoh, Kuala Lumpur
	12.0-13.0	Meat (big size)	Local market, Ipoh, Kuala Lumpur
	100-200	Fins (medium to big size)	Ipoh, Kuala Lumpur
T. lymma	1.0-4.0	Whole body	Local market, Ipoh, Kuala Lumpur

Sharks			
A. marmoratus	1.0-1.5	Whole body	Local market,
C. leucas	25.0-30.0	Whole body	Local market, Ipoh, Kuala Lumpur
	10-15	Meat (big size)	Local market, Ipoh, Kuala Lumpur
	70-150	Fins (medium to big size)	Ipoh, Kuala Lumpur
C. melanopterus	9.0-10.0	Whole body	Local market, Ipoh
C. sealei	5.0-6.0	Whole body	Local market, Ipoh
C. sorrah	5.0-11.0	Whole body	Local market, Ipoh, Kuala Lumpur
C. hasseltii	1.0-4.5	Whole body	Local market, Ipoh, Kuala Lumpur
C. plagiosum	1-4	Whole body	Local market, Ipoh, Kuala Lumpur
C. punctatum	1.0-4.5	Whole body	Local market, Ipoh, Kuala Lumpur

2.3 Larut Matang

2.3.1 Landing Samples

A total of 315 landings were sampled during the study period. The highest number of vessels by month was 30 in April and November followed by 28 in May and October respectively. The highest by gear type was 230 vessels of Zone C followed by 32 of Zone B, and 21 of Zone C2 while 18 was coastal longlines. The details are as shown in **Table 19**.

Table 19: Number of Landings Sampled During the Study at Larut Matang

Gears	Month												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**Total**
Drift net (small mesh size)		3	1	1									**5**
Drift net (big mesh size)						1							**1**
Hook and lines										1			**1**
Longlines	2	1	1			1			2	4	5	2	**18**
Purse seine Zone C2	1												**1**
Push net						1			1	1	2	1	**6**
Trawl nets Zone B	3	2	1	4	1	1	5	3	3	4	4	1	**32**
Trawl nets Zone C	12	18	21	21	26	22	17	20	22	17	14	20	**230**
Trawl nets Zone C2	1		3	4	1	1	1	2	2	1	2	3	**21**
Grand Total	**19**	**24**	**27**	**30**	**28**	**27**	**23**	**25**	**30**	**28**	**27**	**27**	**315**

2.3.2 Fishing Ground and Catch Composition by Gear Type

The main gear landed sharks and rays was trawl nets. Total catch from this gear was 19,586 kg (93.4%)comprising of 13,316kg rays and 6,270 kg sharks. Drift net, longlines, and push nets only contributed about 1,172 kg (5.6%) of rays and drift net, purse seine (Zone C2) and

push net about 211kg (1%) of sharks. Most sharks and rays were landed by trawlers operated in Zone C and Zone C2 beyond 12 and 30 nautical miles respectively from coastlines. A total of 11,516 kg of rays were landed by trawl nets operated in Zone C followed by trawl net operated in Zone C2 at 9,28 kg. As for sharks, trawlers operated in Zone C landed the highest (5,556 kg) followed by trawl nets operated in Zone C2 at 480 kg. The highest landing of rays from trawl net Zone C was in March (1,428 kg), trawl net Zone C2 in April (250 kg) and trawl net Zone B in July at 395 kg. However, the highest landing of sharks from trawl net Zone C was in May (671 kg), trawl net Zone C2 in April (95 kg) and trawl net Zone B in October at 51 kg.The details are shown in **Table 20 (next page)**.

2.3.3 Sharks and Rays Composition

A total of 1,326,633 kg of fish was landed from 315 landings during the study period. Composition of rays and sharks were 14,489 kg and 6,480 kg from total landing. These amount were about 1.1% and 0.5%, while landing of other commercial fish and trash fish were 965,543 kg and 340,121 kg or 72.8% and 25.5% respectively. An average landing per month for sharks and rays were 540 kg and 1,207 kg respectively. The highest landing by month for rays was 1,646 kg in March, followed by 1,608 kg in April and 1,371 kg in May. However, the highest landing of sharks was 777 kg in April followed by 767 kg in September and 701 kg in May. In conclusion, the landing of sharks and rays contributed between 0.3 - 0.6% and 0.8 - 1.5% respectively from total landing. The details are shown in **Table 21**.

Table 21: Catch Composition of Sharks, Rays, Commercial and Trash Fish by Month from 315 Landings at Larut Matang. All Weights in Kilogram

Month	Weight								
	Weight of Ray	% Ray	Weight of Shark	% Shark	Weight of Com.	% Com.	Weight of Trash	% Trash	Total Catch
Jan	936.5	1.3	462.8	0.6	57,660.0	77.2	15,635.0	20.9	**74,694.3**
Feb	1,149.7	1.3	350.9	0.4	67,284.0	75.6	20,210.0	22.7	**88,994.6**
Mar	1,646.0	1.5	357.5	0.3	80,963.0	71.6	30,085.0	26.6	**113,051.5**
April	1,608.0	1.2	777.0	0.6	93,800.0	68.7	40,300.0	29.5	**136,485.0**
May	1,371.2	1.2	700.5	0.6	83,160.0	72.6	29,302.0	25.6	**114,533.7**
June	1,300.5	1.2	473.5	0.4	79,572.0	70.4	31,661.0	28.0	**113,007.0**
July	1,206.8	1.2	556.5	0.6	70,280.5	71.4	26,399.0	26.8	**98,442.8**
Aug	1,259.0	1.0	686.0	0.6	91,845.0	74.2	29,972.0	24.2	**123,762.0**
Sept	1,144.4	0.8	766.5	0.5	113,837.0	75.8	34,397.0	22.9	**150,144.9**
Oct	1,109.5	0.9	420.8	0.3	91,246.0	72.6	32,829.0	26.1	**125,605.3**
Nov	944.6	1.1	353.8	0.4	59,398.5	67.5	27,279.0	31.0	**87,975.9**
Dec	812.9	0.8	574.4	0.6	76,496.5	76.5	22,052.0	22.1	**99,935.8**
Total	14,489.1		6480.2		965,542.5		340,121.0		**1,326,632.8**
Average	1,207.43	1.1	540.02	0.5	80,461.88	72.8	28,343.42	25.5	**110,552.73**

Table 20: Weight of Sharks and Rays (in kg) Caught by Different Types of Gear

Gear	Jan	Feb	March	April	May	June	July	August	Sept.	Oct.	Nov	Dec	Grand Total
Trawl nets Zone B	14.5	21	3	96	3	4	395	96	56.2	83.6	100.02	0.2	872.52
Trawl nets Zone C	813	968.5	1428	1172	1268.2	1134.5	786.8	1088	995.2	723.8	462.55	675.5	11516.05
Trawl nets Zone C2			115	250	100	100	25	75	70	18	65.95	108.82	927.77
Drift net (small mesh size)		120.2	70	90									280.2
Longlines	109	40	30			20			22	283.5	315	27.9	847.4
Drift net (big mesh size						42							42
Push net									1	0.6	1.1	0.5	3.2
Total Catch Ray	**936.5**	**1149.7**	**1646**	**1608**	**1371.2**	**1300.5**	**1206.8**	**1259**	**1144.4**	**1109.5**	**944.62**	**812.92**	**14489.14**
Trawl nets Zone B	5	3.1		34.5		2.5	58.5	16	16	50.75	45.72	1.4	233.47
Trawl nets Zone C	247	347	302.5	647.5	670.5	464.5	497	632	660	339.4	260.15	488.3	5555.85
Trawl nets Zone C2	10.8		55	95	30	3	1	38	90	25	47.95	84.22	479.97
Drift net		0.8											0.8
Purse seine Zone C2	200												200
Hook and lines										5.5			5.5
Push net						3.5			0.5	0.1		0.5	4.6
Total Catch Shark	**462.8**	**350.9**	**357.5**	**777**	**700.5**	**473.5**	**556.5**	**686**	**766.5**	**420.75**	**353.82**	**574.42**	**6480.19**
Grand Total	**1399.3**	**1500.6**	**2003.5**	**2385**	**2071.7**	**1774**	**1763.3**	**1945**	**1910.9**	**1530.25**	**1298.44**	**1387.34**	**20969.33**

2.3.4 Sample Size

A total of 10,594 tails belonging to 6,597 rays and 3,997 sharks were sampled comprising 12 species of rays and eight species of sharks. The most abundant ray species were *Neotrygon kuhlii* followed by *Himantura gerrardi* and *Dasyatis zugei*. The highest number of rays sampled by month was 785 in August followed by 705 in May and 660 in April. The most abundant shark species were *Chiloscyllium hasseltii* followed by *Chiloscyllium punctatum* and *Carcharhinus sorrah*. The highest number of sharks sampled by month was 498 in May, followed by 431 in August and 429 in September. The most common ray species were *Neotrygon kuhlii, Himantura gerrardi, Dasyatis zugei* and *Rhynchobatus australiae* while for sharks were *Chiloscyllium hasseltii, Chiloscyllium punctatum* and *Atelomycterus marmoratus*. All these species were landed throughout the year. Other rays species such as *Gymnura japonica, Himantura jenkinsii, Himantura undulata, Mobula thurstoni, Narcine prodorsalis* were very rare and only landed between 1 - 3 months during the study period. Rarely landed sharks species were *Carcharhinus leucas, Carcharhinus melanopterus*, and *Galeocerdo cuvier*. The details are as shown in **Table 22**.

Table 22: Sample Size of Sharks and Rays by Species

Species	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	Total
Dasyatis fluviorum		1		6	1	3	1		1	1	1		15
Dasyatis zugei	48	86	88	137	164	111	136	194	147	96	97	123	1427
Gymnura japonica								1					1
Himantura gerrardi	45	99	154	162	186	164	162	213	193	116	114	128	1736
Himantura jenkinsii				1			1	1					3
Himantura uarnacoides	2	9	12	5		3	7		3	11	8	2	62
Himantura undulata						3							3
Himantura walga	36	82	39	135	81	88	62	145	88	58	85	99	998
Mobula thurstoni					1								1
Narcine prodorsalis					1							1	2
Neotrygon kuhlii	70	133	221	213	252	216	181	228	220	179	159	211	2283
Rhynchobatus australiae	4	1	6	1	19	5	4	3	6	7	7	3	66
Total Rays	**205**	**411**	**520**	**660**	**705**	**593**	**554**	**785**	**658**	**468**	**471**	**567**	**6597**
Atelomycterus marmoratus	31	28	79	33	110	52	48	32	64	31	30	49	587
Carcharhinus leucas	1		1			1				1			4
Carcharhinus melanopterus								5					5
Carcharhinus sorrah	3			58	103	69	25	16	12		3	3	292
Chiloscyllium hasseltii	72	137	141	214	199	133	188	235	194	147	118	151	1929
Chiloscyllium indicum				8		6	3	1	1	4	4	2	29
Chiloscyllium punctatum	24	39	70	91	85	94	112	142	158	113	90	130	1148
Galeocerdo cuvier				1									1
Sphyrna lewini					1		1						2
Total Sharks	**131**	**204**	**291**	**405**	**498**	**355**	**377**	**431**	**429**	**296**	**245**	**335**	**3997**
Grand Total	336	**615**	**811**	**1065**	**1203**	**948**	**931**	**1216**	**1087**	**764**	**716**	**902**	**10594**

2.3.5 Weight of Sharks and Rays by Species

A total of 20,969 kg of elasmobranch were landed by 315 landings comprising to 14,489 kg of rays and 6,480 kg of sharks. The highest landing by weight ray species was 5,984 kg for *Neotrygon kuhlii* followed by 5,890 kg for *Himantura gerrardi* and 848 kg for *Dasyatis zugei*. The highest landing by month for *Neotrygon kuhlii* was 913 kg in March followed by 833 kg in April and 592 kg in June. For *Himantura gerrardi*, the highest landing was 728 kg in May followed by 719 kg in July and 618 kg in September. The highest landing of *Dasyatis zugei* was 141 kg in August, 97 kg in May and 85 kg in July. All these species were landed throughout the year. Other species contributed between 0.4 kg – 817 kg. The highest shark species landed was 3,190 kg for *Chiloscyllium hasseltii*, 1,802 kg for *Chiloscyllium punctatum* and 932 kg for *Carcharhinus sorrah*. All these species except for *Carcharhinus sorrah* was landed throughout the year. The highest landing by month for *Chiloscyllium hasseltii* was 409 kg in April followed by 405kg in September and 302 kg in December. The highest landing of *Chiloscyllium punctatum* was 262 kg September, followed by 258 kg in August and 225 kg in December. For *Carcharhinus sorrah*, the highest landed was 267 kg in May followed by 201 kg in April and 171 kg June. All these species were landed throughout the year except for *Carcharhinus sorrah*. Rarely landed species throughout a year were *Carcharhinus melanopterus, Galeocerdo cuvier* and *Sphryna lewini*. The details are shown in **Table 23**.

2.3.6 Size Range of Sharks and Rays

In general, most ray species landed from January to June were still immature except for *Dasyatis zugei, Neotrygon kuhlii, Narcine prodorsalis, Himantura undulata* and *Himantura walga*. For *Himantura uarnacoides*, mature specimens were only landed in January and June. Almost all *Himantura gerrardi* landed was juvenile. The size range of this species was between 351 - 419 mm disc length. Mature rays such as Dasyatis fluviorum were landed only in April and June, *Himantura uarnacoides* in January and June, *Rhynchobatus australiae* only in April. A single juvenile *Himantura jenkinsii* specimen was landed only in April. Most of the small sized sharks landed such as *Atelomycterus marmoratus, Chiloscyllium hasseltii, Chiloscyllium indicum* and *Chiloscyllium punctatum* were adults. However big sized sharks such as *Carcharhinus leucas, Carcharhinus sorrah, Galeocerdo cuvier* and *Sphyrna lewini* were juveniles. Size range of all sharks and rays species are shown in **Table 24A**.

Similar to the first six months of 2013, from July to December most ray species landed were still immature except for *Dasyatis zugei, Neotrygon kuhlii, Narcine prodorsalis* and *Himantura walga*. Almost all *Himantura gerrardi* were juvenile. The size range of this species was between 319 - 357 mm disc length. Mature *Dasyatis fluviorum* was landed only in July and *Himantura uarnacoides* in October, November and December. *Himantura jenkinsii* landed in July and August were juveniles. Small sized sharks such as *Atelomycterus marmoratus, Chiloscyllium hasseltii, Chiloscyllium indicum* and *Chiloscyllium punctatum* were mature. Similar to January-June period, big sized sharks such as *Carcharhinus leucas, Carcharhinus sorrah,* and *Sphyrna lewini* were juveniles Size range of all sharks and rays species landed from July to December are shown in **Table 24B**.

Table 23: Weight of Sharks and Rays (in kg) by Species from 315 Landings at Larut Matang.

Species	Jan	Feb	March	April	May	June	July	August	Sept.	October	Nov	Dec	Grand Total
Dasyatis fluviorum		2.2		26.2	2.5	12.3	5.0			2.5	0.4		51.1
Dasyatis zugei	45.4	55.5	42.9	77.8	96.8	73.1	85.3	140.6	72.9	55.2	43.8	59.1	848.3
Gymnura japonica								0.4					0.4
Himantura gerrardi	313.2	341.3	557.5	478.8	727.6	518.0	718.8	548.3	617.6	443.1	346.8	278.8	5889.7
Himantura jenkinsii				0.6			7.8	5.0					13.4
Himantura uarnacoides	28.0	156.0	104.0	72.0		26.5	35.0		22.0	131.0	220.0	22.5	817.0
Himantura undulata						27.0							27.0
Himantura walga	31.6	46.0	15.4	105.5	24.1	44.6	17.6	171.7	38.5	26.9	66.1	79.7	667.6
Mobula thurstoni					14.4								14.4
Narcine prodorsalis					1.0							0.8	1.8
Neotrygon kuhlii	512.3	544.2	913.2	833.1	462.5	591.9	325.3	382.0	369.7	425.2	259.5	365.1	5984.0
Rhynchobatus australiae	6.0	4.5	13.0	14.0	42.3	7.1	12.1	11.0	23.7	25.7	8.1	7.0	174.5
Total weight rays	**936.5**	**1149.7**	**1646.0**	**1608.0**	**1371.2**	**1300.5**	**1206.8**	**1259.0**	**1144.4**	**1109.5**	**944.6**	**812.9**	**14489.1**
Atelomycterus marmoratus	25.0	16.9	41.5	16.2	74.2	28.1	15.1	12.5	28.1	18.6	11.4	33.4	320.9
Carcharhinus leucas	200.0		5.5			3.5				5.5			214.5
Carcharhinus melanopterus								2.5					2.5
Carcharhinus sorrah	14.8			201.0	266.5	171.3	129.0	52.0	71.3		13.3	12.6	931.7
Chiloscyllium hasseltii	165.5	262.1	221.3	408.9	251.3	144.0	252.6	360.2	404.8	216.7	200.8	302.3	3190.3
Chiloscyllium indicum				4.6		2.5	1.0	0.6	0.2	1.2	1.5	1.1	12.6
Chiloscyllium punctatum	57.5	71.9	89.2	142.8	108.0	124.1	156.9	258.2	262.1	178.9	126.9	225.2	1801.6
Galeocerdo cuvier				3.5									3.5
Sphyrna lewini					0.6		2.0						2.6
Total weight sharks	**462.8**	**350.9**	**357.5**	**777.0**	**700.5**	**473.5**	**556.5**	**686.0**	**766.5**	**420.8**	**353.8**	**574.4**	**6480.2**
Grand Total	**1399.3**	**1500.6**	**2003.5**	**2385.0**	**2071.7**	**1774.0**	**1763.3**	**1945.0**	**1910.9**	**1530.3**	**1298.4**	**1387.3**	**20969.3**

Table 24A : Size Range of Sharks (Total Length) and Rays (Disc Length) Except for *Rhynchobatus australiae* (Total Length) from January to June. All measurements in Millimeter

	Month																	
	Jan			Feb			Mar			April			May			June		
	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
Rays																		
D. fluviorum				360	360	360.0				358	504	459.2	370	370	370.0	410	490	451.7
D. zugei	160	320	226.3	160	310	242.2	173	319	237.4	155	315	238.6	155	322	237.4	145	305	227.3
H. gerrardi	160	1050	419.1	200	930	390.6	171	805	379.8	172	775	354.9	180	665	350.5	180	850	356.4
H. jenkinsii										270	270	270.0						
H. uarnacoides	680	700	690.0	410	650	491.1	365	647	467.2	395	845	568.6				685	730	703.3
H. undulata																670	705	685.0
H. walga	130	230	193.9	120	240	196.8	181	241	214.4	142	248	204.5	151	230	200.9	145	240	201.9
M. thurstoni													635	635	635.0			
N. prodorsalis													480	480	480.0			
N. kuhlii	140	340	221.0	120	300	222.6	122	310	226.2	135	310	223.7	102	320	220.0	142	540	225.8
R. australiae	540	760	657.5	1020	1020	1020.0	241	1284	647.7	1370	1370	1370.0	470	1120	713.3	480	920	615.0
Sharks																		
A. marmoratus	450	560	498.4	470	520	498.9	370	571	491.9	322	605	494.6	412	570	503.0	410	555	496.3
C. leucas	2860	2860	2860.0				861	861	861.0							770	770	770.0
C. sorrah	140	730	530.0							505	1520	657.4	375	1225	620.5	520	1250	726.3
C. hasseltii	320	810	590.0	310	810	613.4	418	781	608.3	225	821	597.1	320	810	600.7	405	802	602.7
C. indicum										451	550	511.5				460	575	517.8
C. punctatum	270	870	634.6	430	850	703.6	411	851	669.5	391	912	630.4	415	898	635.9	290	880	691.2
G. cuvier										960	960	960.0						
S. lewini													503	503	503.0			

Table 24B: Size Range of Sharks (Total Length) and Rays (Disc Length) Except for *Rhynchobatus australiae* (Total Length) from July to December. All measurements in Millimeter.

Species	Month																	
	July			August			Sep			Oct			Nov			Dec		
	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
Rays																		
D. fluviorum	440	440	440.0				370	370	370.0	340	340	340.0	205	205	205.0			
D. zugei	140	320	229.0	145	315	229.1	140	320	227.6	95	310	224.8	135	310	228.6	125	310	233.7
G. japonica				160	160	160.0												
H. gerrardi	155	780	363.0	150	670	339.0	160	840	338.9	170	840	356.7	170	820	345.0	170	830	318.6
H. jenkinsii	640	640	640.0	480	480	480.0												
H. uarnacoides	400	610	484.3				415	585	483.3	450	810	620.5	410	1000	780.0	540	700	620.0
H. walga	150	235	203.0	150	240	202.3	140	230	198.3	82	240	193.2	90	245	199.9	115	235	205.4
N. prodorsalis																397	397	397.0
N. kuhlii	135	310	216.9	140	395	222.0	120	310	214.7	135	300	218.8	150	320	212.2	140	300	209.6
R. australiae	510	1100	828.8	860	925	895.0	510	1140	870.8	510	1260	826.4	210	765	551.4	460	1050	686.7
Sharks																		
A. marmoratus	380	555	491.3	385	574	497.1	300	580	489.4	365	550	489.6	185	590	476.5	340	580	489.7
C. leucas										840	840	840.0						
C. melanopterus				395	580	495.0												
C. sorrah	445	1270	830.4	790	970	853.3	800	925	882.5				920	970	940.0	920	950	933.3
C. hasseltii	430	820	597.1	420	810	589.9	350	810	596.7	290	810	592.7	400	790	600.1	210	780	579.0
C. indicum	420	525	485.0	590	590	590.0	430	430	430.0	410	490	465.0	470	540	507.5	540	575	557.5
C. punctatum	375	925	665.5	395	935	689.4	410	870	671.1	410	920	689.4	400	845	656.1	350	900	658.6
S. lewini	720	720	720.0															

2.3.7 Usage and Marketing

Information on marketing showed that almost all sharks and rays were consumed locally and some exported to Singapore such as *Himantura gerrardi, Dasyatis zugei, Neotyrgon kuhlii* and *Rhynchobatus australiae*. The major markets included wholesale market in Selayang, and some local markets such as Ipoh, Sitiawan, Taiping and Kuala Kangsar in Perak. The price varied according to species. Bigger sized *Himantura gerrardi, Himantura uarnacoides* and *Rhynchobatus australiae* were sold up to RM15/kg, while smaller ones at RM5-RM9/kg except *Rhynchobatus australiae* was sold at RM7/kg. The price of *Dasyatis zugei* and *Himantura walga* were the cheapest at RM1 - RM4/kg and RM1 - RM3/kg respectively. In general, the price at Larut Matang was higher as compared to Manjung Selatan and Hilir Perak. Similar to others landing sites, bigger sharks and rays were more expensive than smaller ones.

The most expensive sharks were *Carcharhinus leucas* (RM20 - RM30/kg) followed by *Galeocerdo cuvier* (RM10 - RM12/kg), *Carcharhinus sorrah* (RM9 - RM12/kg) and *Carcharhinus melanopterus* (RM8 - RM10/kg). Other species such as *Chiloscyllium punctatum, Chiloscyllium hasselti* and *Chiloscyllium indicum* were sold at RM1 - RM4/kg. Market destinations for sharks were similar as for rays. Medium and big fins were sold separately to middlemen in Ipoh and Kuala Lumpur. Small sharks with total length of less than 20 cm were sold locally at RM1 - RM1.5/kg. The price at wet markets was about 20 - 50% higher than at landing site. The price was almost consistent for the whole year for all species but can sometimes fluctuate up to 50% when supply was limited. The price range by species at the landing site are shown in **Table 25**.

Table 25: Price of Sharks and Rays by Species at Larut Matang Landing Site in 2013. All Prices in RM per Kilogram. (Exchange rate: RM3.30= 1US$)

Species	Range Price (RM/kg)	Part	Market Destination
Rays			
D. fluviorum	5-7	Whole body	Local markets, Kuala Lumpur
D. zugei	1-4	Whole body	Local markets, Kuala Lumpur, Selangor, Johor, Singapore
G. japonica	3-4	Whole body	Local markets, Kuala Lumpur
H. gerrardi	5-15	Whole body	Local markets, Kuala Lumpur, Selangor, Johor, Singapore
H. jenkinsii	5-6	Whole body	Local markets
H. uarnacoides	9-15	Whole body	Local markets, Kuala Lumpur
H. undulata	9-11	Whole body	Local markets, Kuala Lumpur
H. walga	1-3	Whole body	Local markets, Kuala Lumpur, Selangor, Johor
M. thurstoni	4-5	Whole body	Local markets, Kuala Lumpur
N. prodorsalis	1	Whole body	Local market (trash fish)

N. kuhlii	3-10	Whole body	Local markets, Kuala Lumpur, Selangor, Johor, Singapore
R. australiae	7-12	Whole body	Local markets, Kuala Lumpur, Selangor, Johor, Singapore
	12-13	Meat (big size)	Local markets
	100-200	Fins (medium to big size)	Ipoh, Kuala Lumpur, Singapore
Sharks			
A. marmoratus	1-2	Whole body	Local markets
C. leucas	20-30	Whole body	Local markets, Kuala Lumpur
	20-30	Meat (big size)	Local markets
	100-150	Fins (medium to big size)	Local markets, Kuala Lumpur
C. melanopterus	8-10	Whole body	Local markets
C. sorrah	9-12	Whole body	Local markets, Kuala Lumpur
C. hasseltii	1-4	Whole body	Local markets, Kuala Lumpur, Selangor, Johor
C. indicum	1-2	Whole body	Local markets, Kuala Lumpur, Selangor, Johor
C. punctatum	1-4	Whole body	Local markets, Kuala Lumpur, Selangor, Johor
G. cuvier	10-12	Whole body	Local markets

3.0 OUTPUT AND OUTCOME

The project outputs and outcomes are summarised in **Table 26** as shown below.

Table 26. Output and outcome

No	Output	Outcome
1.	Sixteen trained personnel in sharks and rays taxonomy from the Department of Fisheries Malaysia.	Trained staffs are now able to make the right and valid identification of species. Training materials stored electronically and easy to excess.
2.	A standardised format for data collection for national activity produced.	Improved technique of data collection for implementation at national level
3.	Detailed information on the percentages of sharks and rays from the total landing at pilot project sites.	Confirmed earlier data published in Malaysian National Statistics. Sharks and rays were not targeted and contributed to only about 2% of total marine landing.
4.	Information on relative dominance of the different species of sharks and rays obtained.	Increased awareness of needs and measures for shark conservation and management on specific species.
5.	Information on the monthly fluctuation of the different species of sharks and rays obtained.	Trends of landings by species analysed for national level management.
6.	Stage of maturity for the different species of	Increased awareness of needs and

	sharks and rays determined.	measures for shark conservation and management among stakeholders
7.	Information on usage and marketing of the landed sharks and rays were obtained from the pilot project.	Confirmed earlier report in current NPOA-Sharks that all sharks and rays are landed whole, fully utilised with no finning activities onboard vessels.
8.	A report on landing of sharks and rays up to species level from three sites in Perak.	Data recording on sharks and rays will be improved from generic terms 'sharks' and 'rays' to species level.
9.	Issues and problems arising from this activity identified and improvements made especially with the data collection format	Development of a comprehensive national data collection system for sharks and rays as part of the National Plan of Action Sharks
10.	Specimens collected during sampling activities deposited for future reference.	A national repository for elasmobranchs has been established at the Fisheries Research Institute, Kg. Acheh, Perak Malaysia

4.0 FUTURE ACTIVITIES

Malaysia will continue to record landing data up to species level at an additional eight sites in Peninsular Malaysia in 2014. Data collection at the current three landing sites is to be continued. Awareness programme will be continued in other parts of the country.

5.0 CONCLUSION

Recording landing data of 13 species of sharks and 17 spesies of rays up to species level were successfully implemented at three major districts in Perak. The summary of all species are as shown in **Appendix III**. The project was successfully implemented including the training of personnel in taxonomy of sharks and rays, printed and disseminated of awareness materials in major languages, public consultations of NPOA Sharks as well as public awareness campaign on conservation of sharks and rays. Photos of the activities are as shown in last part of this report **(Appendix IV).**

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Training Schedule on Taxonomy and Biology of Elasmobranchs 3-7 February 2013

Day	Time	Activity	Oficer In-charge: L=Lecturer F=Fasilitator S=Secretariat
Sunday 3 February	08.00-08.15	Registration	Mr. Osman Muda (F) Mr. WahabDaud (F) Mr. RuzelanJusoh (S) Ms. NoridaMohamad Noor (S)
	08.15-08.30	Introduction to training course	Mr. Ahmad bin Ali (L)
	08.30-09.30	Lecture 1: Introduction to NPOA-Shark (Malaysia)	Mr. Abdul Haris Hilmi Ahmad Arshad (L)
	09.30-10.30	Lecture 2: Status of Sharks and Rays Biodiversity in Malaysia.	Ms. Anie Lim Pek Khiok (L)
	10.30-11.00	Coffee break	
	11.00-1.00	Lecture 3: Introduction to Biology of Sharks and Rays.	Mr. Ahmad Ali (L)
	13.00-14.30	Lunch	
	14.30-16.30	Lecture 4: Introduction to Taxonomy of Sharks and Rays.	Ms. Anie Lim Pek Khiok (L)
	16.30-17.00	Tea break: End of day one.	
Monday 4 February	08.30-10.30	Practical 1. Technical Term and Measurement of Sharks.	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. WahabDaud (F)
	10.30-11.00	Coffee break	

	11.00-13.00	Practical 2: Clasification of Sharks. Key to Order, Class and Family.	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	13.00-14.30	Lunch	
	14.30-16.30	Practical 3. Clasification of Sharks. Key to Genus and Species.	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	16.30-17.00	Tea break: End of day two	
Tuesday 5 February	08.30-10.30	Practical 4. Technical Term and Meaurement of Rays, Skates and Chimaera.	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	10.30-11.00	Coffee break	
	11.00-13.00	Practical 5. Clasification of Rays, Skates and Chimaera. Key to Order, Class and Family.	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	13.00-14.30	Lunch	
	14.30-16.30	Parctical 6. Clasification of Rays, Skates and Chimaera. Key to Genus and Species.	Mr.Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	16.30-17.00	Tea break: End of day three	

Wednesday 6 February	08.30-10.30	Practical 7. In Team Work. Identify of Sharks up to Species Level.	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	10.30-11.00	Coffee break	
	11-00-13.00	Practical 8. In Team Work. Identify of Rays, Skates and Chimaera up to Species Level.	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	13.00-14.30	Lunch	
	14.30-16.30	Practical 9. Presentation of Team Work (Identification of Common Sharks, Skates, Rays and Chimaeras in Malaysia up to Species Level)	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	16.30-17.00	Tea break: End of day 4	
Thursday 7 February	08.30-10.30	Exam 1: Practical: Identification of Sharks, Skates and Rays Specimens up to Species Level (in laboratory)	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	10.30-11.00	Coffee break	
	11.00-12.00	Exam 2: Theory (in Conference room)	Mr. Ahmad bin Ali (L) Mr. Abdul Haris Hilmi Ahmad Arshad (L) Ms. Anie Lim Pek Khiok (L) Mr. Osman Muda (F) Mr. Wahab Daud (F)
	12.00-12.30	Evaluation of training activities	
	12.30-13.00	Closing remarks and presentation of certificate	Mr. Ahmad Ali
	13.00-13.30	Lunch: End of training course	

SAMPLE OF STANDARD FORM

Data Collection Project on Sharks and Rays (BOBLME)

Name of Enumerator: _____ Date:_____

Name of Landing Site:_____ Vessel Registration No:_____

GRT :_____

Type of Gear:_____ Fishing Area:_____ No. of days/trip:_____

A. Standard Operation Procedure:

1. This form is for a single sampling vessel.
2. Collect all fish (sharks and rays) if catch is less than 50 tails or 10-50% of the landed catch if more than 50 tails. Take samples randomly.
3. Separate them by species and sex.
4. Measure total length for all sharks and rays from the Family Rhynchobatidae, Rhinobatidae, Narcinidae and Narkidae. Measure disc length for other ray species.
5. Record weight of all sharks and rays by species.
6. Record weight of commercial and trash fish.

B. Measurement of sample (Sharks)

No.	Species	Sex	Total length (mm)					
1								
2								
3								

C. Actual Weight of Sharks by Species

No	Species	Weight (Kg)
1		
2		
3		

D. Measurement of sample (Rays)

No.	Species	Sex	Total length/Disc Length (mm)					
1								
2								
3								
4								

D. Actual Weight of Rays by Species

No	Species	Weight (Kg)
1		
2		
3		
4		
5		

3. Total Catch of Sampling Vessel

No.	Vessel Registration No	All Sharks	All Rays	Commercial Fish	Trash Fish	TOTAL
1.						

5. Price of Sharks

Species	Price/Kg (Small size)	Price/Kg (Medium size)	Price/Kg (Big size)	Market Destination

6. Price of Rays

Name of Rays	Price/Kg (Small size)	Price/Kg (Medium size)	Price/Kg (Big size)	Market Destination

Note: _____

Checklist of Shark and Ray Species Recorded During the Study Period

No	Orders/Families	Site 1	Site 2	Site 3
	ORDER MYLIOBATIFORMES	**Hilir Perak**	**Manjung Selatan**	**Larut matang**
	Family Dasyatidae			
1	*Dasyatis fluviorum*	/	/	/
2	*Dasyatis zugei*	/	/	/
3	*Himantura gerrardi*	/	/	/
4	*Himantura jenkinsii*	x	/	/
5	*Himantura uarnacoides*	/	/	/
6	*Himantura granulata*	x	/	x
7	*Himantura walga*	/	/	/
8	*Himantura undulata*	x	x	/
9	*Neotrygon kuhlii*	/	/	/
10	*Taeniura lymma*	x	/	x
11	*Pastinachus gracilicaudus*	x	/	x
	Family Gymnuridae			
12	*Gymnura poecilura*	/	/	x
13	*Gymnura japonica*	x	/	/
	Family Mobulidae			
14	*Mobula thurstoni*	x	x	/
	ORDER RHINOBATIFORMES			
	Family Rhinobatidae			
15	*Rhinobatus formosensis*	/	x	x
	Family: Rhynchobatidae			
16	*Rhynchobatus australiae*	/	/	/
	ORDER TORPEDINIFORMES			
	Family Torpedinidae			
17	*Narcine prodorsalis*	x	x	/
	Total ray species	*9*	*13*	*12*
	ORDER CARCHARHINIFORMES			
	Family: Scyliorhinidae			
1	*Atelomycterus marmoratus*	/	/	/
	Family Carcharhinidae			
2	*Carcharhinus leucas*	/	/	/
3	*Carcharhinus sorrah*	/	/	/
4	*Carcharhinus melanopterus*	x	/	/
5	*Rhizoprionodon acutus*	/	x	x
6	*Scoliodon laticaudus*	/	x	x
7	*Carcharhinus sealei*		/	x
8	*Galeocerdo cuvier*	x	x	/

	Family Sphyrnidae			
9	*Sphyrna lewini*	/	x	x
	ORDER ORECTOLOBIFORMES			
	Family: Orectolobidae			
10	*Chiloscyllium hasseltii*	/	/	/
11	*Chiloscyllium indicum*	/	x	/
12	*Chiloscyllium plagiosum*	/	/	x
13	*Chiloscyllium punctatum*	/	/	/
	Total shark species	*10*	*8*	*8*

Photos Taken During the Taxonomy and Biology Training Sessions (3-7 February 2013)

Photo 1. Participants and resource persons

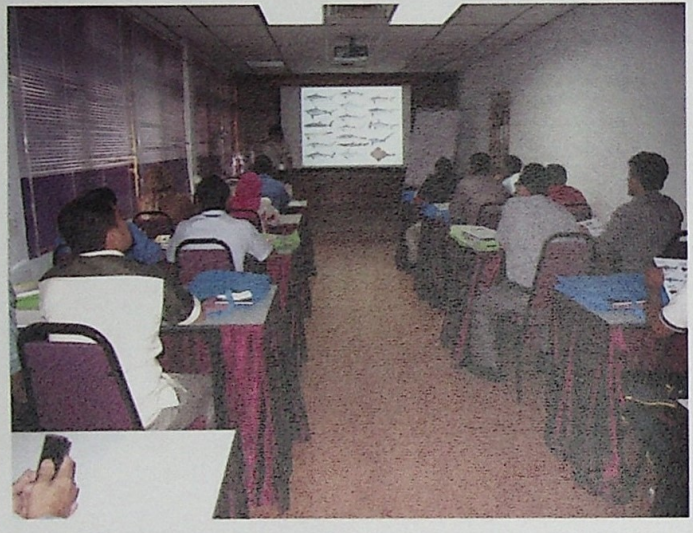


Photo 2. Participants during lecture session

Photo 3. Some common sharks specimens used during the training session

Photo 4. Some of the common rays specimens used during the training session

Photo 5. Group exercise in sharks species identification

Photo 6. Group exercise under the guidance of experts

Photo 7. Participants being guided on the biology of sharks

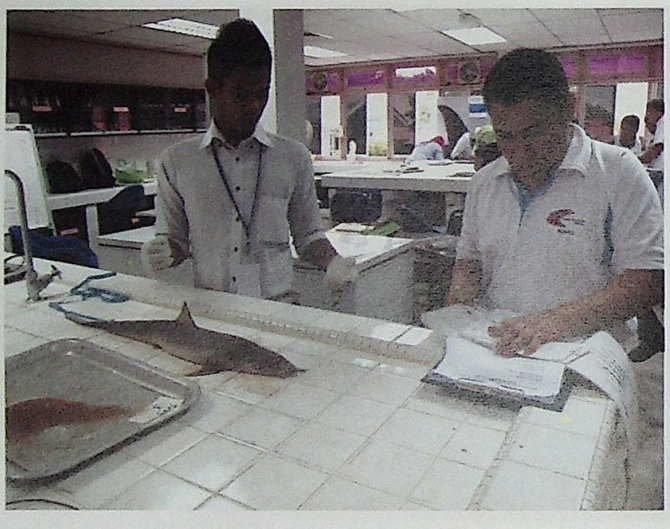


Photo 8. Participants undergoing test session on their understanding of taxonomy and biology

Photo 9. Participants sitting for the final test

Photos Taken During the Data Collection Activities (Jan-Dec 2013)

Photo 1. Data analysis workshop involving enumerators and researchers

Photo 2. Sorting of rays species at landing jetty in Manjung Selatan

Photo 3. Sharks sorted, packed and ready for market

Photo 4. Rays as by-catch of trawlers

Photo 5. Sharks as by-catch of trawlers

Photo 6. Sharks sold together with other bony fishes in market at Hutan Melintang

Annex 2

FINAL REPORT

Stakeholder Consultations NPOA-Shark

CONTENTS

1.0 Background

Malaysia has been very supportive to the voluntary International Plan of Action (IPOASHARKS) developed under the FAO which culminated in the development of its own National Plan of Action for the Conservation and Management of Sharks (Plan 1) in 2006. The establishment of Plan 1 is consistent with Malaysia's commitment to adhere to the principles of international fisheries instruments aimed at achieving sustainable fisheries as enshrined in the National Agro-food Policy.

Malaysia shares the global concern about shark-related issues. In light of this, Malaysia joins the global effort in improving conservation and management measures which premised upon the fact that sharks are widely distributed both within waters under national jurisdiction and on the high seas alike. Moreover, Malaysia also subscribes to the importance and significance of international cooperation and coordination to achieve the long-term conservation and sustainable use of sharks.

Moving on the successful development of the second Malaysia's National Plan of Action for the Conservation and Management of Sharks (Plan 2) is a manifestation of its renewed commitment for continuous improvement of sharks conservation and management measures in Malaysia. In relation to this, it is worth mentioning that the successful implementation of the action plans is underpinned by strong cooperation among stakeholders and concerted efforts by all parties.

2.0 Overall Objective

The overall objective of the NPOA-Shark is to ensure the conservation and management of sharks and rays and their long-term sustainable use, as espoused in the FAO IPOA-Shark which aims to:

- Ensure that sharks and rays catches are sustainable;
- Assess threats to sharks and rays population, determine and protect critical habitats, and implement harvesting strategies consistent with the principal of biological sustainability and rational long-term economic use;
- Identify and provide special attention in particular to vulnerable or threatened sharks and rays stocks;
- Improve and develop framework for establishing and coordinating effective consultation involving stakeholders in research, management and educational initiatives within and between States;
- Minimise unutilised incidental catches of sharks and rays;
- Contribute to the protection of biodiversity and ecosystem structure and functions;
- Minimise waste and discards from sharks and rays catches in accordance with Article 7.2.2 (g) of the Code of Conduct for Responsible Fisheries (for example, requiring the retention of sharks from which fins are removed);

- Encourage full use of dead sharks and rays;

- Facilitate improved species-specific catch and landings data and monitoring of sharks and rays catches; and

- Facilitate the identification and reporting of species-specific biological and trade data.

2.1 Specific Objectives

The main goal of the NPOA-Shark is to conserve, manage, rehabilitate and sustain sharks and rays resources in Malaysia. The purpose of this consultation is to review the Plan 1 as required under the IPOA–Shark. Paragraph 23 of the IPOA-Shark requires member States to conduct assessment of effective implementation of their NPOA-Shark at least once in every four years. The successful outcome of the Plan 2 would be the sustainable exploitation of sharks and rays and enhancement of the population of those species that are endangered or threatened. Through this effort, future generations will continue to benefit from an economic, recreational and educational perspective.

2.2 Activities During the Stake Holders' Consultation

Lessons learned from the Plan 1 was used as a basis for the improvement of this Plan 2.The main strategy of the Plan 2 is to focus on the issues and take a direct action either through programs or projects that are most effective in solving the issues. In essence the plan is action oriented. The issues are categorized into short, medium and long term priorities, under which seven action plans were proposed. For each issue, relevant programs / projects are required to be implemented in order to achieve the successful outcome of the plan.

In order to assess the crucial issues in the NPOA-Shark from the viewpoint of different stakeholders, a series of three consultations in collaboration with the Department of Fisheries Malaysia and Department of Fisheries Sabah were held at Putrajaya Convention Center on 21 October, at Semporna, in Sabah on 4 November and at Kuching in Sarawak on 16 December 2013. About 70-200 participants from relevant government agencies, fisheries association, private sectors, non-governmental organisations, fishers, researchers and local lecturers attended at each consultation. These consultations aimed to compile feedbacks from stakeholders on their views and opinions on the current implementation of the current NPOAShark and future plans on conservation and management of sharks under Plan 2.The outcome of the consultations will be a priority list of issues on which what kind of trainings are needed or what kind of management strategies are necessary for the different stakeholders. Photos of the activities are as shown in last part of this report **(Appendix I)**.

During the consultations, an evaluation was conducted to assess the implementation of Plan 1 in terms of action taken against the action plans. Plan 1 identified five key issues and challenges in the management and conservation of shark namely biological information of sharks and related habitats; socio-economic information of fishers and traders; utilization, marketing and trade information; coordinated research and expertise on sharks; and inadequate management. These issues were translated into seven key action plans broadly

described as strengthening of data collection on biology and related habitats; strengthening of data collection on socio-economic of fishers and traders; strengthening of data collection on trade; encouraging the utilization of elasmobranch catches; capacity building and coordinated research; and, effective conservation and management.

The review of the Plan 1 showed that some of the action plans were successfully implemented and achieved its goals while some were either not fully or yet to be implemented. It was also identified that the implementation of all action plans are still relevant and will be included in the Plan 2. Therefore, there is an urgent need for the Plan 2 to be developed and implemented.

2.3 Output and Outcome

In Plan 2, 17 issues were identified and clustered. The issues were categorized into short, medium or long term priority, under which seven action plans were proposed. For each issue, relevant programs / projects were required to be implemented in order to achieve the successful outcome of the plan. Specific programs were outlined and prioritized. Programs ranked as "High" will have to be carried out within one year, while "Medium" within 2-3 years and "Low" in 4 years. The details of the action plans and priority listing are shown below:

ACTION PLAN 1 **IMPROVEMENT OF DATA COLLECTION**		
Issues	**Action**	**Priority**
Misreporting of sharks and rays species due to insufficient training	SEAFDEC and DoFM are preparing a field guide on identification of sharks and rays species. More training and workshops on taxonomy and biology are to be organized	High
Deficiency in data collection on biology, socio-economy and trade	Conduct more thorough data collection on biology, socio-economy and trade	High
Difficulties in recording all sharks and rays species biodiversity (63 species of sharks and 69 species of rays)	Record landings for top ten of sharks and rays species	High
ACTION PLAN 2 **RECTIFYING NEGATIVE PERCEPTION ON TERMINOLOGY**		
Issues	**Action**	**Priority**
Misreporting or misconception on terminology of shark finning and sharks fisheries	Intensify public awareness programs	High

ACTION PLAN 3 INTENSIFYING CAPACITY BUILDING		
Issues	**Action**	**Priority**
Insufficient knowledge on biology, taxonomy, ecology and resource assessment	Conduct more training cources and workshops on biology, taxonomy, ecology and stock assessment of sharks and rays	High
	Conduct more consultations involving stakeholders in research, management and education	High
	Conduct resource surveys in deep-sea areas	Medium
	Participate in seminars and meetings related to the issues at national, regional and international levels	Medium
ACTION PLAN 4 STRENGTHENING CONSERVATION AND MANAGEMENT		
Issues	**Action**	**Priority**
Conflict of interest between ecotourism and fisheries	Engage stakeholders in conservation and management through Ecosystem Approach Fisheries Management (EAFM)	High
	Support the ongoing programs on alternative livelihood from capture fisheries to other activities.	High
	Promoting 'catch & release' activity during fishing tournament/contest/competition	Medium
	Conduct feasibility studies on areas of conflict	Medium
By-catch of sharks and rays juveniles by monsoon trawlers in coastal waters	Conduct awareness programs among operators of trawlers and other relevant stakeholders	High
Insufficient rehabilitation, conservation and resource enhancement activities on sharks and rays	Conduct more programs on rehabilitation and enhancement of sharks and rays resources through deployment of artificial reefs.	Medium
Limited cooperation in conservation and management of shared, straddling and highly migratory sharks and rays species at regional level	Promote more data and information sharing in conservation and management measures of sharks and rays species at regional level	Low
ACTION PLAN 5 STRENGTHENING LAW AND ENFORCEMENT		
Issues	**Action**	**Priority**
Incidental catch of protected species and endangered	Intensify awareness program on laws and regulations	High

species		
Freshwater sharks and rays is under state jurisdiction	Propose to state government to establish and include the management of freshwater sharks and rays in their state fisheries rules and regulation	Medium
Insufficient expertise to identify sharks and rays species and their derivatives listed under CITES and Fisheries (Control of Endangered Species of Fish) Regulations 1999	Conduct projects on DNA bar-coding on sharks and rays species	High
Absence of finning regulations under the current legal framework	Amend existing regulation or impose conditions on fishing licence	Medium
ACTION PLAN 6 COMPREHENSIVE AND COORDINATED RESEARCH		
Issues	**Action**	**Priority**
Insufficient comprehensive research on various aspects (biology, friendly gear, resource enhancement, taxonomy, etc)	Conduct comprehensive and coordinated research.	Medium
Limited resources (facilities, funding)	Request budget for research facilities and implementation	Medium
ACTION PLAN 7 SECURING FUNDING		
Issues	**Action**	**Priority**
Insufficient sustainable and specific funding to monitor and implement NPOA-Shark	Use NPOA-Shark to justify in funding applications	High
Stringent bureaucratic mechanisms to receive funding from international donors.	Simplify the fund channelling mechanism	High

Appendix 1

Photos Taken During Consultations

Photo 1. Consultation at Putrajaya Convention Center

Photo 2. Consultation at Semporna in Sabah

Photo 3. Consultation at Kuching in Sarawak

Annex 3

FINAL REPORT

Awareness Building Seminar

CONTENTS

1.0 Background

There is a very low level of communication between scientists and stake holders on sharks and rays especially on trade, conservation and implementation of the NPOA-Shark. Scientists and decision makers sometimes work separately and most of them have different views and ideas especially on the conservation and management issues. Therefore, there is a need for the scientists, decision makers and stake holders to understand the current local and international issues on the elasmobranch especially on their biology, ecology, mode of reproduction and life cycle. Raising awareness among the stake holders, decision makers and public is essentials as it is one of the activities recommended during the Regional Workshop on the Development of the Regional Management Plan (RPOA) for Sharks in the BOBLME Region held in Male, Maldives from 5-7 July 2011.

2.0 Overall Objective

To establish better communication between scientists, decision makers, stakeholders and public on conservation and management of sharks and rays in Malaysia.

2.1 Specific Objectives

- To conduct public awareness campaigns which involve fishery managers and other decision makers, students, relevant NGOs, fishers and public through a series of consultations and campaign.
- To raise awareness especially on endangered flagship species such as whale shark and sawfishes.
- To educate stake holders on the vulnerability of these species to fisheries and the need for special conservation and management measures.
- To publish and distribute pamphlets on conservation of sharks and rays in major local languages.

2.2 Activities During Stake Holders' Consultation

Stake holder consultation is one of activity proposed under Awareness Building Program. Three stake holder consultations on sharks and rays were held at Kuala Sepetang on 28 May, Lumut (29 May) and Bagan Datoh on 30 May 2013. A one-day program started from 10 am to 5 pm and was jointly organized with SEAFDEC/MFRDMD, Perak State Fisheries Office and Extension Division of the Department of Fisheries Malaysia.

Activities included during the one-day campaign program were exhibition of posters and materials of endangered species including sharks and rays, lecture on conservation and management of sharks and rays and discussion with stake holders on the need to conserve sharks and rays species especially whale shark and saw fishes (family Pristidae). Photos of the activities are as shown in last part of this report **(Appendix I)**.

2.3 Outcome and Output

All together between 500-1000 visitors including fishers and their family, pupils and local government officials visited at each campaign site. Based on feedback received after the campaigns, most visitors especially fishers, school children and local communities are now better aware on the needs to conserve sharks and rays especially endangered species such as whale sharks and sawfishes. These activities were reported in the local newspapers as well as a special article in the Department of Fisheries Malaysia quarterly fisheries bulletin 'Berita Perikanan' in 2013. The Department of Fisheries Malaysia will extend the same campaigns in other states using national funding.

Appendix I

Photos Taken During the Public Awareness Campaigns

Larut Matang (28 May 2013)

Photo 1. Poster on conservation of sharks and rays species with BOBLME and DoF Malaysia logos displayed

Photo 2. Rostrum of endangered fresh water sawfishes and jaw of bull shark

Photo 3. Pupils from local primary schools at a display table of endangered species

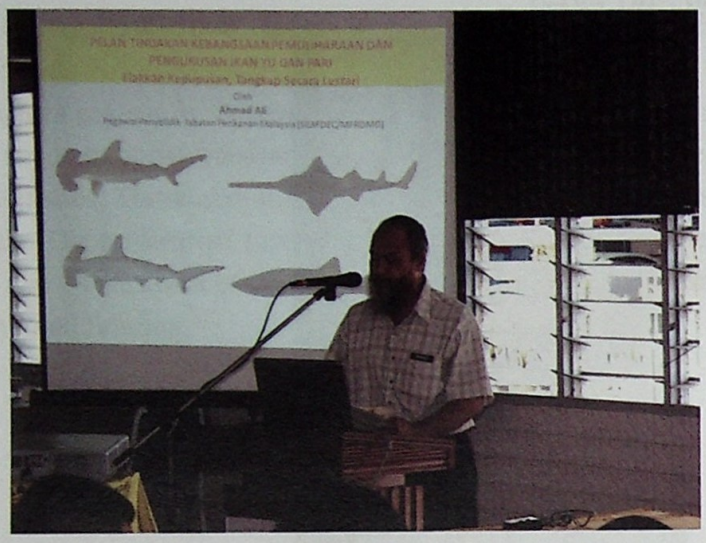


Photo 4. Presentation on conservation and management of sharks and rays resources

Photo 5. Dissemination of booklets on sharks and rays to local leader

Photo 6. Poster on the need to conserve sharks and rays displayed at landing site

Photo 7. Poster on conservation of sharks and rays published by BOBLME and DoFM displayed at local primary school to enhance knowledge on the biology of sharks and rays

Photo 8. Sawfish rostrum displayed at a local Chinese temple as a sign of respect

Manjung Selatan (29 May 2013)

Photo 1. Sawfish rostrum displayed attracted many older fishers of all races because this fish was common during their younger age

Photo 2. The District Officer for Sitiawan was also attracted to the sawfish rostrum on display

Photo 3. Some of the participants during the public awareness campaign

Photo 4. Lecture on conservation of sharks and rays during public awareness campaign

Photo 5. Stakeholders from various ethnic groups during public awareness campaign

Photo 6. Pupils from local schools attracted to the display

Hutan Melintang (30 May 2013)

Photo 1. Fishers and their family members during the public awareness campaign

Photo 2. Pupils from local primary schools showed their interests at the display of the sawfish rostrum

Photo 3. Rostrums of endangered sawfishes (*Pristis microdon* and *Pristis zijsron*) displayed during the public awareness campaign

Photo 4. Stakeholders participating during the campaign

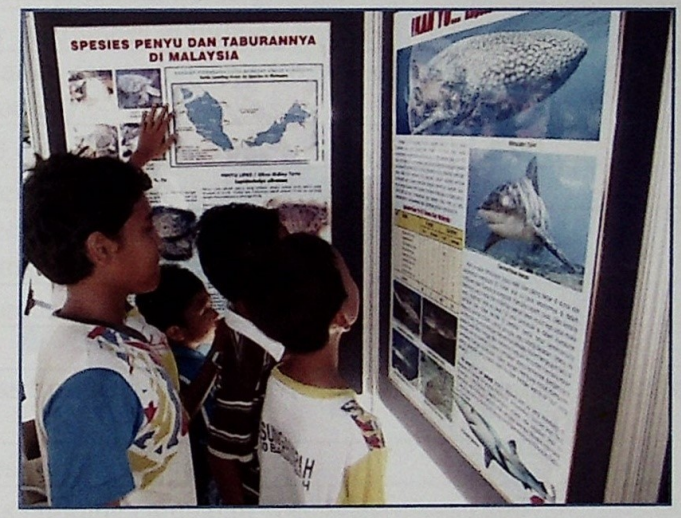
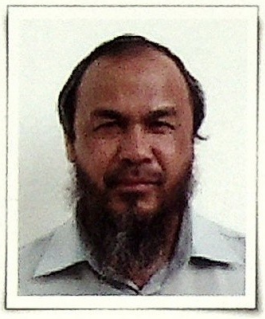


Photo 5. Posters on whale sharks and other endangered species displayed during the public awareness campaign

AUTHORS OF THE BOOK



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